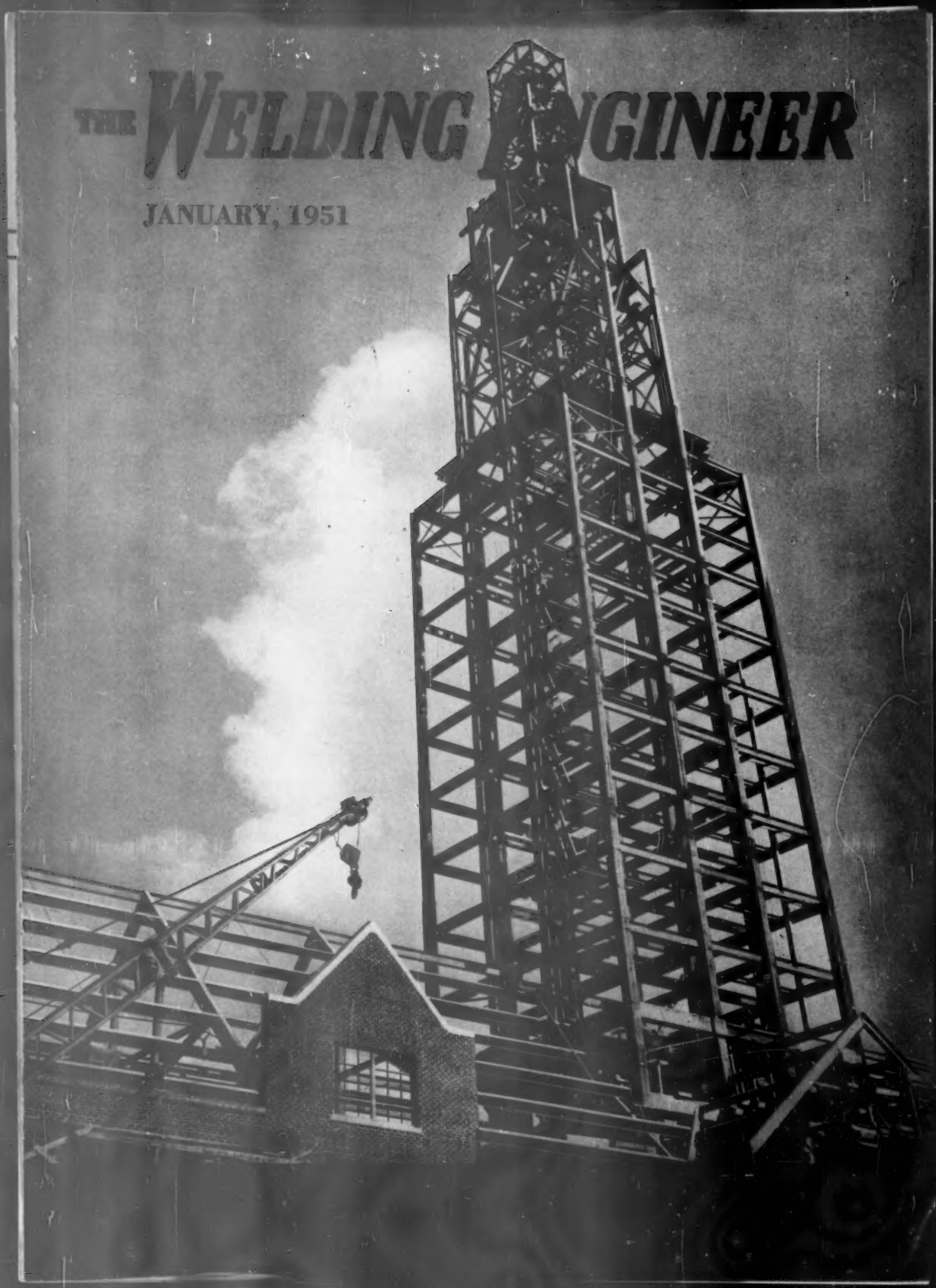
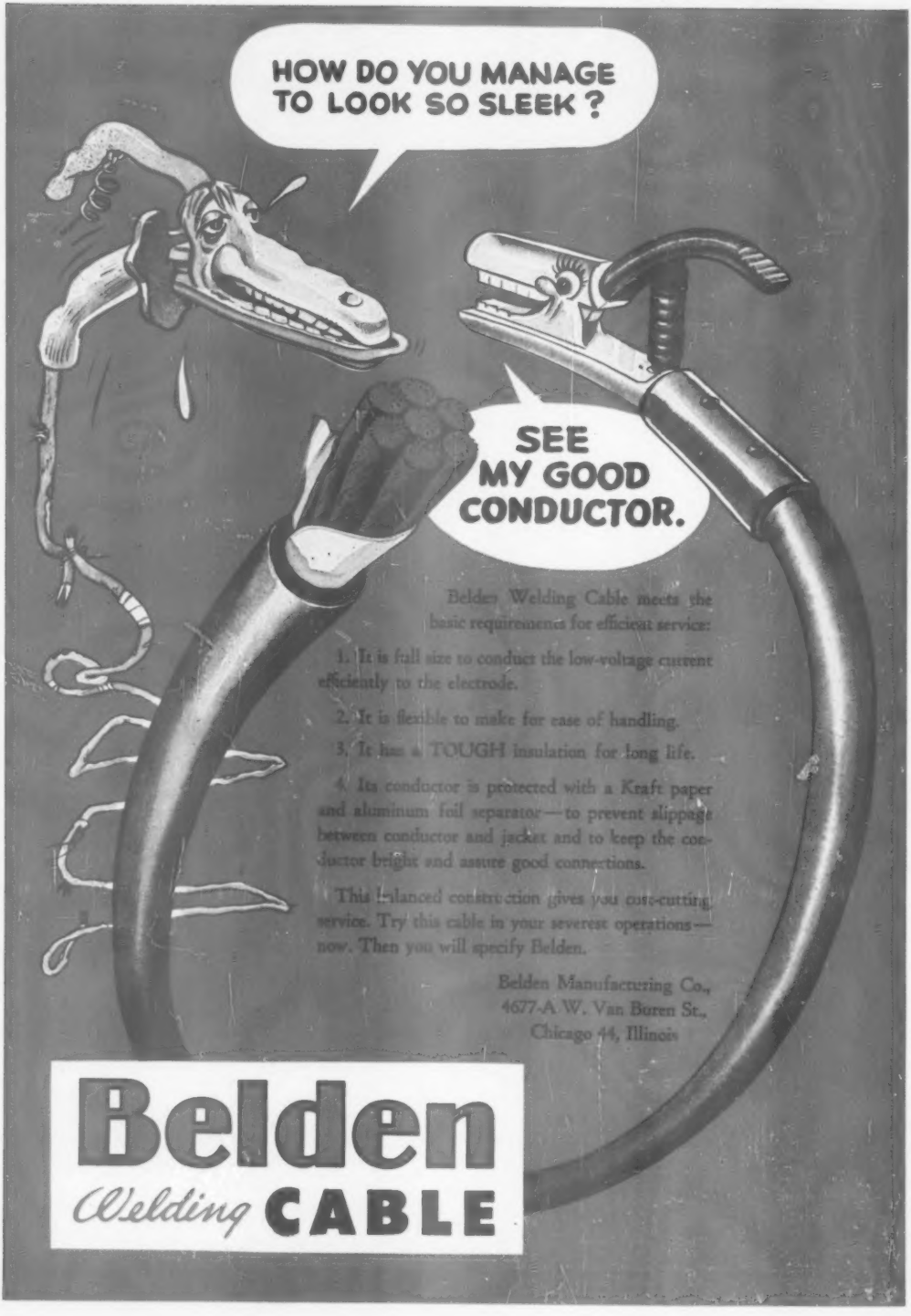
THE WELDING ENGINEER

JANUARY, 1951





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VOLUME 36 — Number 1

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THE WELDING ENGINEER • JANUARY • Vol. 36—No. 1

(with which is combined The Acetylene Journal)
Member ABC and ABP

Published monthly, with an additional directory number in June, by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Publication Office 210 S. Desplaines St., Chicago 6.

Executive and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 18, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Editorial Offices: 520 No. Michigan Ave., Chicago 11, Ill.

Subscriptions: Address correspondence to The Welding Engineer—Subscription Service, 330 W. 42nd St., New York 18, N. Y. Allow ten days for change of address. **Please indicate position and company connection on all subscription orders.**

Single copies 50c. Subscription rates—United States and possessions $5 a year; $8 for two years; $10 for three years. Canada $6 a year; $10 for two years; $13 for three years. Pan-American countries $10 a year; $16 for two years; $20 for three years. All other countries $15 a year; $25 for two years; $30 for three years. Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of Mar. 3, 1879. Printed in U. S. A.

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THE WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

JANUARY, 1951

COVER: *All-welded scaffolding of Gold Star Memorial Library of Oklahoma City University.* *See page 17.*

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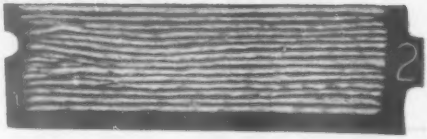

Ampco-Trode overlays more than double bearing shoe life — Locomotive roller-bearing shoes last thousands of miles longer with Ampco-Trode 200 overlays. Number 2 binders, the most severe location, last 80,000 miles — compared to 40,000 for phosphor bronze wear plates. Shoes in 1, 3, and 4 locations last 300,000 miles between shoppings. New shoes are given a two-layer, 5/16" overlay (3½ hours welding time); worn shoes are rebuilt with a one-layer, ¼" overlay (2 hours welding time).

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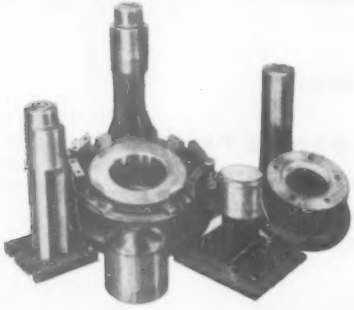
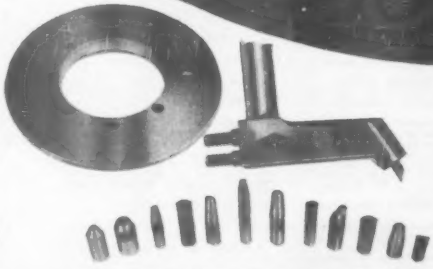
Ampco Bronze



Ampco-Trode overlays outlast chrome plate 4 to 1 — A large Detroit manufacturer carefully counted the costs on these draw punches and rings. They found that overlays of Ampco-Trode 300 lasted 4 times as long as chrome plate. The longer life more than offset the lower initial cost of chrome. In addition, press-room efficiency increased nearly 15% by eliminating down-time previously required to hone and polish dies in the middle of production runs.



Resistance-welding costs cut with long-wearing Ampco electrodes — Rigorous production schedules call for trouble-free operation. Ampco resistance-welding electrodes are ideal for this kind of service. They combine hardness and toughness to resist mushrooming and wear. Their high electrical conductivity resists sticking to the work. They need less dressing — reduce downtime, increase production. The complete Ampco-weld line — tips, wheels, dies, standard and special holders — are made of alloys with the highest physical properties. All meet or exceed RWMA specifications.

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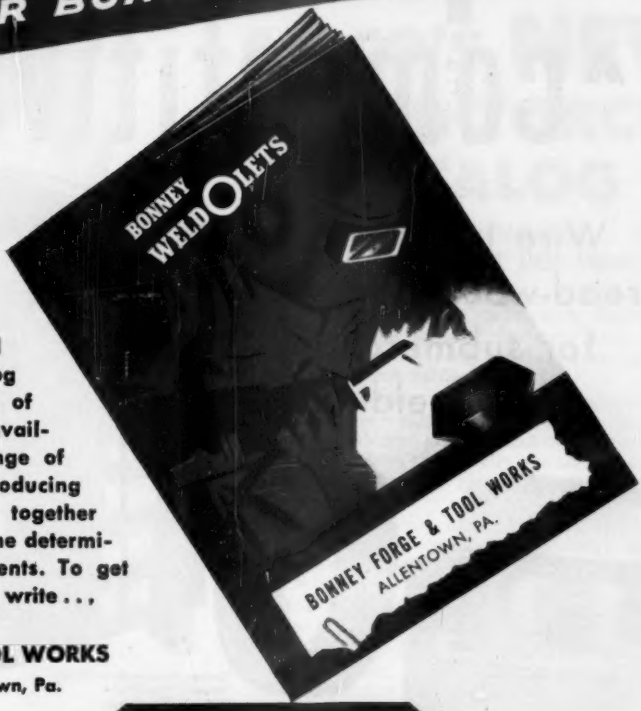

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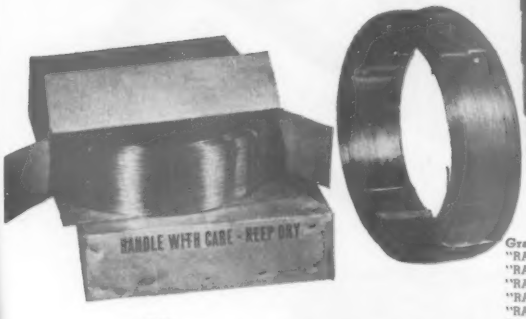

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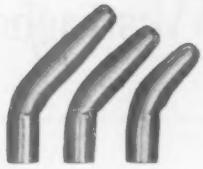

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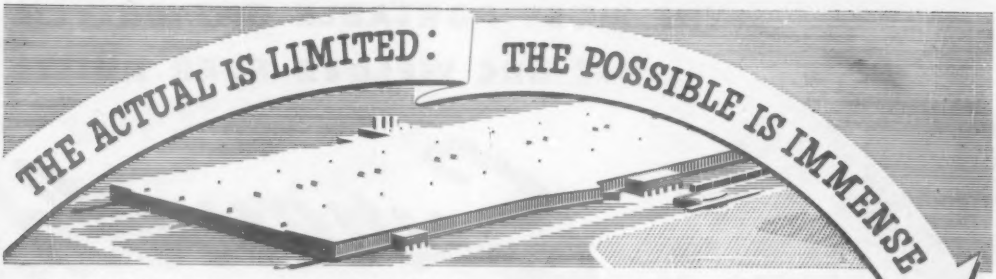


NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1951

Manufacturer cuts machining time by converting to welded design

A SAVING of 0.28 man-hours per piece is now being realized in the production of the scale beam shown. By converting the design of this part to welded steel, it has become possible to pre-machine components on smaller equipment as well as eliminate some machining operations entirely.

In place of the original construction shown, the machinery member is now produced simply from a plain angle and two steel straps. The resulting greater strength of the adopted steel design is providing both improved product performance and better sales appeal. The cost of this one part alone has been cut from $2.57 to 71¢ . . . a saving of 72%.

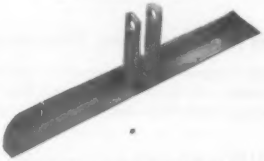
How To Steel Design With Welding. Complete, up-to-date design data now available in new, 9th Edition, Procedure Handbook of Arc Welding Design and Practice. Price only $2.00, postpaid in U.S.A.; $2.50 elsewhere.

Continuous Weighing Machine *of the Schaffer Poidometer Company, Pittsburgh, Pennsylvania. Arrow points to scale beam originally used and now replaced with welded design.*

the **ACTUAL**

Original Construction: *Machinery beam. Cost $2.57 . . . weight 10 pounds.*

increasing the **YIELD**



Present Design: *Simplified with welded steel . . . Costs only 71¢ . . . weighs only 7 pounds.*

the **IMMENSITY** of the **POSSIBLE** turns out to be a **COST REDUCTION OF 72%**

SEE HOW WELDING SIMPLIFIES PRODUCTION

Machine Design Sheets free on request. Designers and engineers write on your letterhead to Dept. 71,

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

THE WELDING ENGINEER

ESTABLISHED 1914 JANUARY, 1951

Our 35th Birthday

As AMERICA's pioneer welding publication, THE WELDING ENGINEER has played a vital role in the growth of an important segment of the metal-fabricating industry. Back in January, 1916, when our first issue came off the press, welding was looked upon only as a maintenance process of dubious value. Among the few men who had confidence in the infant metal-joining process was the late L. B. Mackenzie.

Mackenzie had tremendous faith in welding. He knew that it was the first wholly new method of joining metals (if we except the forge welding of the blacksmith shop) developed in several thousand years. He knew that it was the only way to join metals as they should be joined; *i.e.*, with a homogeneous bond instead of by screws or pegs (called bolts and rivets) as wood parts have to be joined. There was only one thing wrong with welding, felt Mackenzie: too few people knew about it.

It was Mackenzie's idea that the process would grow only if the world could have a free exchange of welding knowledge. He backed up his convictions by becoming a publisher and launching THE WELDING ENGINEER.

With this January, 1951, issue we celebrate our 35th birthday. No other publication can boast of so long a period of service to the welding industry.

Within a few short years after the founding of THE WELDING ENGINEER, a sufficiently large number of men had become interested in welding to found the American Welding Society. This new organization gave a professional status to welding experts and furnished the means by which unbiased research could be conducted. Hail to such men as Dr. Comfort A. Adams and other early leaders of AWS! They built soundly.

As THE WELDING ENGINEER grew in years and in number of pages, new processes were invented; creative engineering imagination carried welding on into more and ever more fields. Men working with metals the world over learned of the new developments in the pages of THE WELDING ENGINEER.

Today all industry has become dependent upon welding. That's a broad statement, but it can easily be proved. Name any specific industry you choose; it uses machines and machines are made of metal—metal parts to be joined and kept together by welding. Worn surfaces of metal tools are built up by new and harder surfaces deposited by welding or by the closely related metallizing process.

It's a well known fact that when a metal-fabricating job is too tough to handle by any other process, it can be welded. Even widely dissimilar metals—copper and mild steel, for instance—can be joined together in a lasting bond.

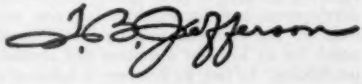
Last month we told of welded piping built to withstand temperatures of 1,050 F and pressures of 1,800 psi. Without such installations, today's modern high-pressure steam generating stations could not be used for the production of electric power. Without welded pipes and pressure vessels, we would not have 100-octane gasoline nor many of the miracle drugs today available to fight infection. Penicillin, for example, cost a young fortune per gram until it was mass-produced in welded tanks.

Because it has been found possible to weld together thin filaments, we have the electronic tube . . . radio, television and a host of other gimmicks it would take a book to discuss. But if welding has made possible the electronic tube, the electronic tube has also helped welding. Precise control of time and temperature in the field of resistance welding is effected by electronic controls.

Resistance welding makes us think, naturally, of the automobile plant. The extensive use of welding has placed the modern motor car within the price range of nearly every American.

Welding also made possible the atomic bomb. And welded cyclotrons are used to produce the new atomic isotopes that will aid in fighting illness.

Yes, welding has become a landslide, and it is hard to see where it will not go nor what it will not embrace. But the first few rocks that started the whole thing were set rolling back in 1916 by a fellow who felt that there should be a free exchange of welding ideas. He deserves a lot of credit, don't you think?



HIGH-VOLTAGE RADIOGRAPHY

cuts exposure time from hours to minutes...

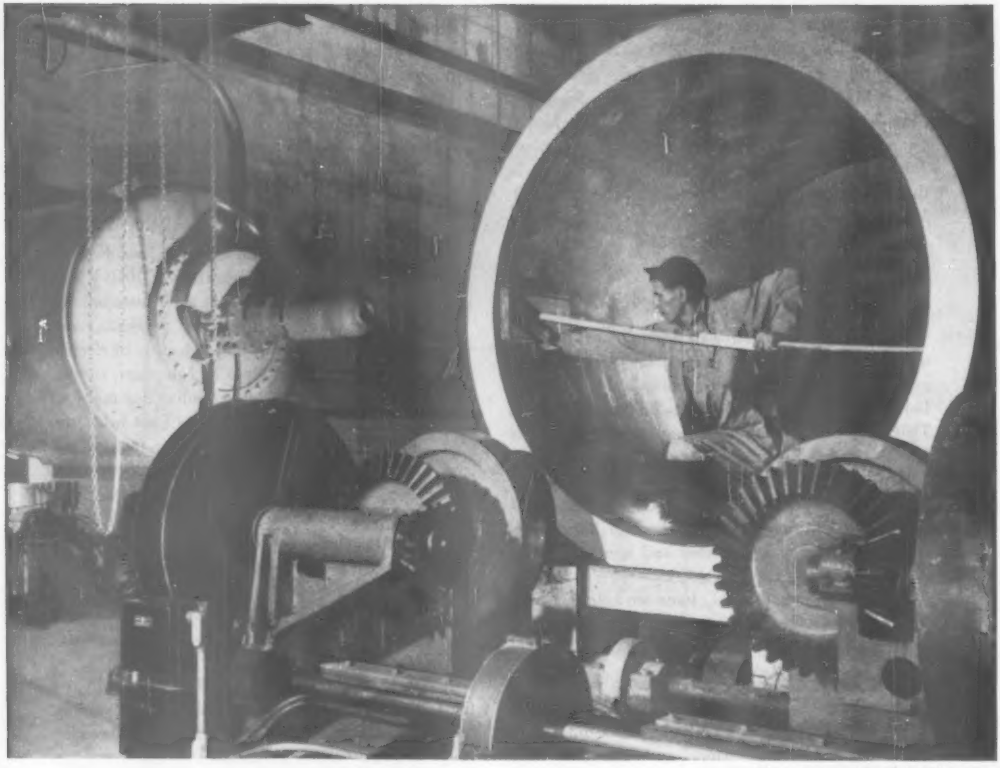


Photo courtesy Babcock & Wilcox

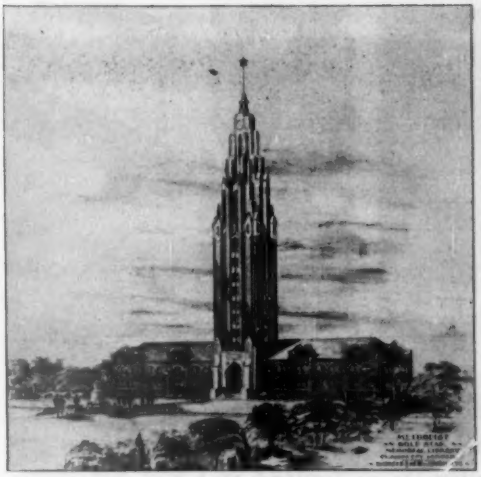
Provides proven dependability year-in... year-out plus low-cost operation

Vessels which would take up to eight hours or longer to radiograph with lower-voltage x-ray units take as little as six minutes with 2,000,000 volt industrial x-ray units like the one shown above. And the detail improvement over low-voltage radiography is dramatically apparent.

Scores of companies rely on high-voltage radiography, not only as an inspection tool — but as a development tool for establishing new welding technics. The high-voltage x-ray unit illustrated is noted for its low-cost operation and absolute dependability. In fact, its economy is summed up by many users like this: "From a cost standpoint, high-voltage x-ray appears to be the more economical method of inspecting fusion welding in pressure vessels."

Radiography may be the answer to your own welding inspection and development problems. Write today for full information. General Electric X-Ray Corporation, Dept. AE-1, Milwaukee 14, Wis.

GENERAL ELECTRIC X-RAY CORPORATION



FROM ARCHITECTS' drawing to actual steel, the new Gold Star Memorial Library of Oklahoma City University

Welding Goes UP!

Tallest all-welded structure yet built is the 250-foot tower of a new million-dollar library in Oklahoma City. About 35% of the welding was done in the shop.

BY L. G. STEVENS

Sureweld Div., National Cylinder Gas Co.

ONE OF the year's most talked about structures among welding men is likely to be the 250-ft library tower in Oklahoma City, now nearing completion. The 23-story tower of Oklahoma City university's Methodist Gold Star library is the tallest all-welded structure yet built. Only a few rivets can be found, these being where beams butt into columns around the stairwell in the center of the building. Otherwise, the structure is all welded, from its base to the pinnacle of its structural steel.

This new building is important to the welding industry for one particular reason: it will lend the authority of fact to the oft-proclaimed theories of those who have long advocated the techniques used in its construction.

One-Third Shop Welded

As much as possible of the welding was done in the shop, approximately 35% altogether. It is estimated that the building's design-for-welding resulted in a 10% or more saving in shop labor. Even more important to builders is the 10% saving in steel that was also effected. Bad weather can play havoc with building schedules, as every builder knows, but when a third of the welding may be done inside, the effects of weather are obviously much reduced as a delaying factor.

Roof Welded, Too

The gable roof as well as the tower of the library was welded. In the fabrication of the roof framing, shop welding also played an important part. By prefabricating the roof framing, a minimum of field welding was left to be done in assembly.

Western Steel Erection Co., the Oklahoma City contractor doing the job, used four weldors and four welding machines for a total of 910 man-hours. Some peculiar problems were encountered. Because the tower was slender—34 ft square—it was necessary to erect one column height, either two or three floors, and then shut down the raising gang until all the column splices and beam connections were completely welded. After that, the guy derrick could be jumped; it was jumped one column section height—two or three floors.

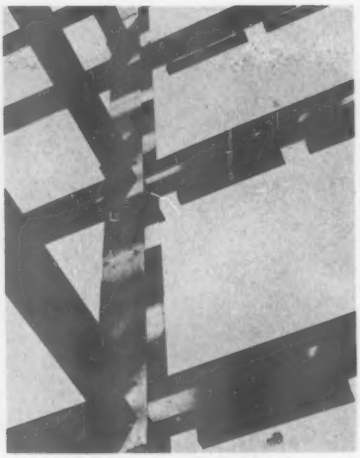
The important fact learned from this job is that the raising gang would have been permitted to work continuously if the structure had been 100 ft square or more. The same techniques would have been employed, but the economies would have been considerably greater.

As it was, the savings effected by the method of building were by no means inconsiderable. One major saving, and it cannot be measured, is the vast amount of time that would have been required for fitting steel together aloft. And there is no way to guess how costs would have risen had the steel been raised and then failed to fit, as sometimes happens.

Design and Dimensions

The first setback of the 250-ft tower is located 178 ft above ground level. Up to this height, the tower is 34 ft square. At the first setback it shrinks to 23 ft square, continues at 23 ft for the next 27 ft of height, goes down to 10 ft square at a height of 205 ft above ground. The 10-ft square section continues for the next

1—HOW BEAMS seat on the columns. Beam seats are shop welded. The connection is typical of those used on the tower's first nine floors.



2—SPLICE on a lower floor column. Weight is changing from 103 to 87 lb/ft

For Lower Floors

31 ft of height. For the next 8 ft of height, the tower is 6 ft square, tapering down to its ornamental roof during the final 6 ft of height. How it will look when finished is best shown by the drawing on page 17.

Column Weights

Columns at the base of the tower are 14-in. WF beams of 150 lb per ft. As the structure rises, the 14-in. WF columns become lighter until the column section weighs only 78 lb per ft. At this point there is a transition to a 12-in. WF column at 65 lb per ft, followed by a 10-in. WF at 49 lb per ft and finally an 8-in. WF at 31 lb per ft.

Columns were milled and spliced with flange plates. The latter plates were shop welded to the lower section of the column and field welded to the upper section; small web plates were also field welded. Four bolts were provided for erection and alignment.

Beam seats were shop welded to the columns to connect them to the beams. The beams were welded to their seats in the field. An I-beam section or plate was field welded to the top flange of the beam and to the column. Columns were provided with two bolts in each flange for erection. Field assembly time was drastically cut by the practice of making holes and placing the erection bolts in the shop.

Figure 1 shows a column connection typical of those between the first and tenth floors (not including the tenth). The flange bracket seat (left center) is a $\frac{5}{8}$-in. plate 9 in. square; it is held in place with two fillet welds $\frac{3}{8}$ in. by $3\frac{1}{2}$ in. on bottom and top sides. A $\frac{3}{4}$-in. triangular plate with 6-in. legs is welded to the flange and bracket by a $\frac{3}{8}$-in. continuous fillet weld, made on both sides. All of this is shop welding. In the field, the beam was fastened to the lower bracket by $\frac{3}{8}$-in. fillets extended along each edge for 6 in.

The top flange bracket was cut from a 24-in., 90-lb-per-ft I-beam. It was fastened to the column and beam by $\frac{3}{8}$-in. continuous fillet welds.

On the column web, the lower bracket is of $\frac{3}{4}$-in. plate, while the brace is from 1-in. plate. This bracket is shop welded, $\frac{3}{8}$-in. fillets. The upper bracket is $\frac{5}{8}$-in. plate.

Once the alignment of beams and column is completed and the bolts are in place, all that remains is to arc weld. The time-saving accomplished by the careful shop preparation is tremendous.

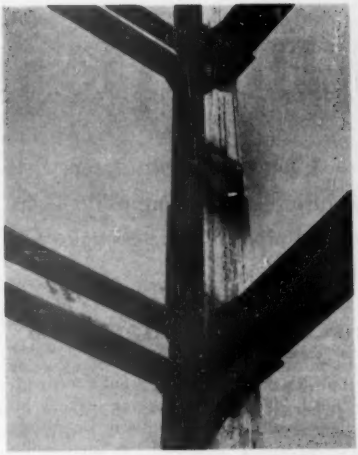
Upper Floor Connectors

Column connections for the tenth to fourteenth floors are pictured in Fig. 4. The details are similar to those for the lower floors except that the web bracket plates are only 6 or 7 in. deep so as to extend outward from the web to be approximately flush with the flange. Plates of $\frac{5}{8}$-in. thickness are used for the top and bottom brackets.

Splicing Methods

Going back to the lower floors, a typical column splice between transitions in the 14-in. WF column appears in Fig. 2. Here the column weight is changing from 103 to 87 lb per ft. Note the lintels attached to the right-hand beams: these are 5 by $3\frac{1}{2}$ by 5/16 in. angles, which are welded in place by 3 by 2 by $\frac{1}{4}$ in. angle clips on 1 ft 6 in. centers—all shop welding.

Figure 3 is a column splice used just above the thirteenth floor level, showing the transition from 14-in. WF 78 lb-per-ft column to 12 in. WF, 65 lb per ft. This splice plate is $\frac{1}{2}$ in. thick, 9 in. wide by 19 in. long, and overlaps 9 in. on the 14-in. column. It is shop welded with a $\frac{3}{8}$-in. fillet across the bottom and for 6 in. up each side. A $\frac{3}{4}$-in. plate filler 10 in. square is welded on each side of the 12-in. column with a $\frac{3}{8}$-in. continuous fillet weld, after which the $\frac{1}{2}$-in. splice plate is welded to the filler plate. The field weld starts where the shop weld was stopped on one side and goes around to meet the shop weld on the other side.



3—TRANSITION made from 14-in. WF 78-lb column to 12-in. WF 65-lb column

4—CLOSE-UP of a column-beam connection for an upper floor. Web bracket plate extends outward from the web, nearly flush with flange

For Upper Floors

On all column splices and beam connections, $\frac{3}{8}$-in. fillet welds were used. The bracing, however, was welded with $\frac{1}{4}$-in. fillet welds. The erectors employed E-6012 electrodes for flat and horizontal welding; E-6010 electrodes for overhead and vertical welding. Altogether, a total of 3,800 lb of electrodes were used.

Column Base Plates

To gather up some additional details, the column base plates were approximately $2\frac{1}{2}$ ft square and 3 in. thick. These plates were shipped loose and set with leveling screws. The columns were milled with angles shop welded to them. Columns were not field welded to the base plates but are held by the anchor bolts.

The gabled roof of that section of the building outside the tower was field bolted. However, the rafters were field welded at the peak, and the tie beams were also field welded.

The tower is to be capped with a 5-ft revolving star, to be illuminated day and night. It is this that gives the library its title of the Gold Star Memorial Library.

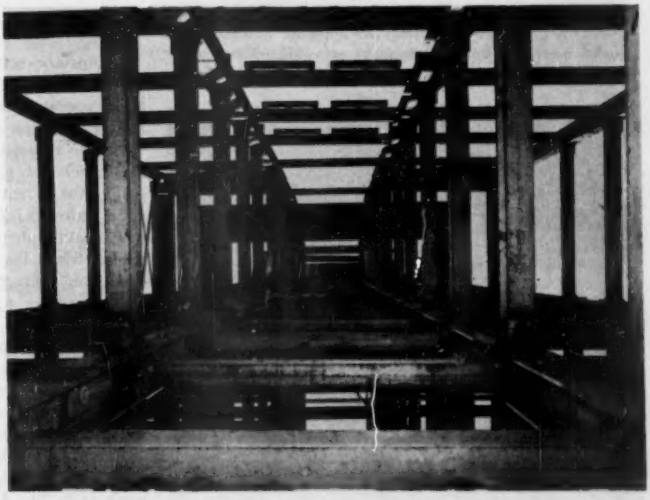
Will Cost a Million

The structure was started in December, 1949, and is slated for completion early in 1951. When finished, it will cost a million dollars and hold a quarter of a million books.

The erectors term the experience of this job valuable and important. They acknowledge a saving in building costs and foresee others if the advantages of all-welded structures are fully considered in the planning stages. Though this is the first building of its type in the Oklahoma City area, it will not be the last if the general satisfaction of all concerned in the job is any criterion.

* * *

Architects for the job were Winkler & Reid. Lippert Bros., Inc., was general contractor. Steel was furnished and fabricated by the Robberson Steel Co. Western Steel Erection Co. put up the steel, and LeCrone Welding Supply furnished the electrodes. All of these concerns are Oklahoma City firms.



LOOKING UP from floor to floor. To see this view as the camera saw it, hold the magazine above your head, then bend your head back and glance up

Hot Tie-in

A hot tie-in really means hot: you do the cutting and welding while flames burn around the pipe. It's safe enough—but don't let the gas go out!

BY CLINTON WING AND FRED STETTNER
Victor Equipment Co., San Francisco

1—WHERE it happened. Eastern end of the by-pass is in foreground; western end on other side of highway

2—PIERCING the pipe line. As soon as a hole was made, the torch flame ignited the escaping natural gas

3—CUTTING operator wears an asbestos suit to protect him from the ring of flames encircling the pipe

IF YOU KNOW how it's done, you can cut out a section of a pipe line filled with natural gas and make a hot tie-in. A hot tie-in really means hot; you do all the cutting and rewelding with a circle of flames surrounding the pipe.

The above operation was performed recently at Bella Vista near Pittsburgh, Calif., by the Standard Pacific Gas Line, Inc. "Stanpac," as it is more familiarly known, acts as owner and operator of a 190-mile natural gas pipe line running to the San Francisco Bay area. A new "free-way" (highway) was slated to be built over a section of the pipe line, which had to be relocated so that it would be accessible after the free-way was completed (see Fig. 1). It was necessary to cut out sections from the main 26-in. pipe line to allow space for a by-pass line to be placed in position.

Victor Equipment Co. was interested in this job because our research and development department had designed a stainless-steel cutting torch for use on extremely hot and rough service. A job like this, we felt, would give a very thorough test under field conditions. It did, and we were satisfied.

WHITE CONE OF ESCAPING GAS

Before any cutting could be done, communication was established on the company's private telephone line between operators at control valve stations at points on both sides of the new by-pass and at the relief valve between these two stations. At 11 a.m. William Johnson, Stanpac superintendent, gave word to close off the main line control valves. When this operation was complete, the center relief valve was opened. The release of the high-pressure gas to atmosphere provided both a visible and audible show. When the cold gas contacted the atmosphere, it formed a white cone 50 to 100 feet high—and was accompanied by a roar that could be heard for miles around.

After the gas pressure had dropped to approach zero, the relief valve was throttled down. A small amount of leakage from the control stations at either end of the by-pass was allowed, however, to build up a slight amount of pressure in the line.

It was now safe for the Stanpac crew on the eastern side of the by-pass to pierce the pipe with the cutting torch (Fig. 2). As soon as the hole was made, the torch flames ignited the escaping gas. The cutting operators had to wear asbestos suits to protect themselves from

on Pipe Line

the flames circling the pipe while they worked (Fig. 3).

The size of the burning circle was carefully controlled by telephoning instructions to the operator at the relief valve. Just the right amount of pressure was established to maintain a reasonably sized flame as the cut proceeded around the pipe.

Gas Kept Burning

Important: The escaping gas had to be kept ignited at all times. This was looked after by the operator doing the cutting and by an assistant standing by with a lighted torch (Fig. 4). Should the flame disappear at any time, the two men were told to withdraw their torches immediately and wait until the pressure was re-established since any mixture of air and gas inside the pipe would be explosive.

To prevent air from entering the pipe after the cut was completed, a wet canvas was wrapped and strapped over the cut (see Fig. 5).

A similar cut was made about eight feet beyond the original cut to allow a section of the main line to be removed. The cutting was done in a similar manner with flames enveloping the pipe. Both ends of the pipe were then closed off and strapped with wet canvas.

A second crew on the western end of the by-pass line performed the same operations to cut out a second section from the main line. Then the new by-pass was lowered into place and temporarily tied into the western end of the main line. The canvas was removed from the eastern end of the line, and the pipe was raised up in a position for purging.

Purging was done by reopening the main line at the western end, and it proved to be quite a spectacular operation. All accumulated dirt, rust and other debris came roaring and rattling down the line and out the end of the pipe in a huge cloud of dirty brown dust and flying particles. As soon as the gas came out clean, the pressure was reduced. The by-pass was placed in position on both ends to tie in to the main line, and a butt strap was placed around it.

Weldors Worked "Hot" Too

The joints were rapidly arc welded into place (Fig. 6), the weldors observing the same precautions about keeping the gas lighted.

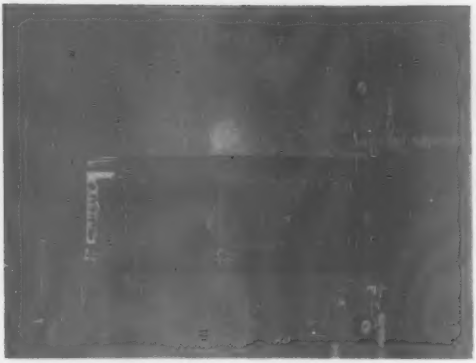
Between 11 a.m. and 1:30 p.m. the whole operation was completed and normal service resumed. The entire job was accomplished with such a high degree of timing, teamwork and coördination that service to consumers was not affected.

The 190-mile pipe line involved in this hot tie-in runs from the Kettleman Hills area in the southern San Joaquin valley to the San Francisco bay area. Stanpac, the owner and operator of the natural gas pipe line, is itself jointly owned by the Pacific Gas and Electric Co., Standard Oil Co. of California and Pacific Public Service Co.

4—HELPER stands by with a torch ready to relight the flame if it goes out. All escaping gas must burn

5—SEALING OFF the completed cut. Wet canvas prevents air from entering pipe and mingling with the gas

6—JOINING by-pass line to main pipe line. A butt strap was placed around the pipe ends and arc welded



1—VACUUM CHAMBER of the 200-ton, 60-in. cyclotron in position between the two big electromagnets

2—ASSEMBLING one of the aluminum-alloy sections for frame of vacuum chamber. The plate is 2½ in. thick

Atom-Smasher Chamber

Like to know how to weld 2½-in. thick plates of aluminum? Here's the technique that was developed for the frame of the vacuum chamber of a 60-in. cyclotron.

BY JACK MEDOFF

A 200-TON, 60-in. cyclotron is nearing completion at the University of Washington, Seattle. This $500,000 atom smasher will be capable of accelerating alpha particles to 40 million electron-volt energies and deuterons to approximately 20 million. As the acceleration works best in a vacuum, there must be a sturdy vacuum chamber capable of holding a high vacuum continuously.

The vacuum chamber (Fig. 1) is located between the two giant electromagnets that will help accelerate low-energy particles until they attain energies of millions of electron-volts. The frame for the boxlike chamber is made up of upper and lower plate sections, separated for a distance of 12 in. by six spacer posts. Each of these irregular plate sections is approximately 70 by 72 by 2½ in. and has a center hole 56¾ in. in diameter.

TABS AND BACK-UP BARS

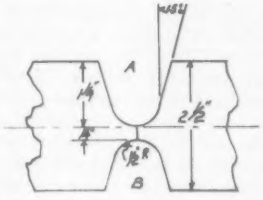
Figure 2 shows how a section is assembled. The four pieces were cut from a 2½-in.-thick plate of 61 ST-4 aluminum alloy, 40 by 62 in. Four butt welds were made to join the components: one 4 in. long, two 8 in. and one 10 in.

Double U-groove butt welds were specified. Dimensions are given in the upper sketch. To guarantee complete penetration and full reinforcement at the starting and finishing points, full-section tab-on plates 2 in. wide were added at both ends of each butt weld. These may be seen in Fig. 3, a view of one section of the chamber assembled in preparation for welding. A 1-in. round aluminum bar was fitted into the underside groove on each weld to act as a backing and keep weld metal from falling through.

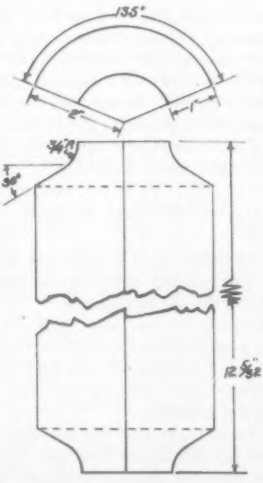
Figure 4 shows the completed 4-in. butt weld with the tab-on plates providing for full and adequate weld reinforcement. This weld was finished in 1½ hours.

Inert-arc welding was used with high-frequency-stabilized alternating current and argon shielding gas. The 700-amp arc torch held a 5/16-in. tungsten electrode. The filler rod was a ¼-in. rod of aluminum alloy.

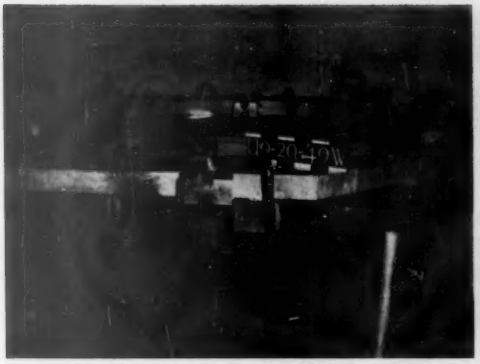
The thick plate had to be preheated to 600 F for 12 in. on each side of the weld. Eleven passes were deposited on one side; the assembly was then rotated to put the second side uppermost. All of the base metal in the second side was chipped away



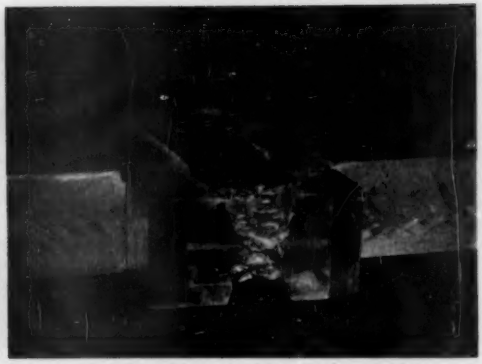
JOINT preparation for double U-groove butt welds in plates



SPACER posts joining top and bottom were prepared as above



3—LOWER SECTION of assembly has been clamped in jig for welding. Note the full-section tab-on plates



4—BUTT WELD 4 in. long was completed in 1½ hours. Tab-ons eliminated all weak spots at starts and stops

5—ROTATING POSITIONER used to weld on the spacer posts. Here a post is being welded on the inside of plate section by inert-arc process

6—JOINING spacers to the other plate section to complete frame

to sound weld metal. The second side was completely welded with 14 passes, and the assembly was turned back as it was at first. Six more passes on the first side completed the weld.

The welding current varied from 500 to 700 amp. To afford adequate protection, an argon flow of 60 cfh was maintained by paralleling three flowmeters. The welding rod was double-lengthened to 6 feet so the operator could hold it without discomfort. Transverse shrinkage across each weld was ¼ in.; this was allowed for in setting up.

Welding Spacer Posts

Figure 5 shows one of the sections in the rotating positioner used to add the six spacer posts. One of the posts was fillet welded on the inside. Six passes were required on the inside welds of the spacers, from 12 to 15 passes on the outside.

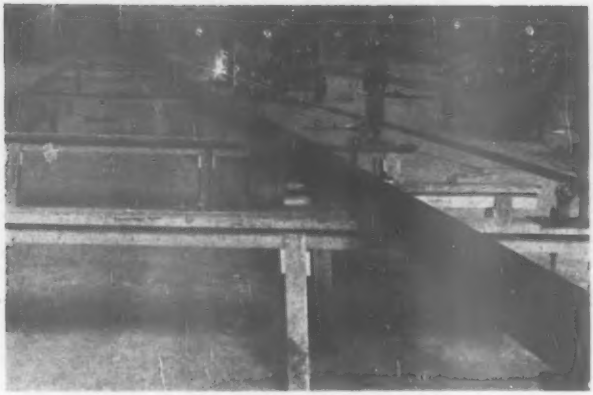
To secure exactly 12-in. spacing between plate sections, the spacer posts were made 12 5/32 in. long as each fillet weld shortened the post by 5/64ths of an inch. Dimensions and edge preparation of the posts are given in the lower sketch. Aligning a post and making the inside fillet weld took about 1½ hours.

The welding technique consisted of positioning the spacer in the four o'clock position and rotating clockwise, completing the weld in the eight o'clock position. When the inside weld had been made, the operator melted out the root to sound weld metal with his torch to prepare for welding on the other side. The outside weld was then made in the 12 o'clock position, requiring 12 to 15 passes. Currents from 500 to 700 amp were used, the higher currents being needed for the melting.

After the six spacers were attached to one section, the other section was set up and joined, one post at a time. This precaution was necessary to assure proper alignment to within the required tolerance of 1/64 in. The sections were preheated to 600 F, and each post was aligned and welded in sequence, progressing around the circumference of the assembly. Figure 6 shows final welding on a spacer.

Total actual welding time was approximately 50 hours. About 80 lb of ¼-in. welding rods were used, and 21 cylinders of argon were consumed.

Photos courtesy of The Linde Air Products Co.



1—LONG LENGTHS of 1¼-in. pipe were welded on wooden horses. The pipe was turned on ten sets of roller bearings (shown at right)

2—HYDROSTATIC testing was done in the 195-ft-long water trough at left

Building an Ice Floor

Arc welding speeds construction of the arena floor and refrigeration for a new $1,000,000 ice palace.

BY RICHARD G. SWISHER
Hobart Bros. Co., Troy, O.

SOMETHING unusual for a town of of 12,000 population is the new million-dollar sports arena at Troy, O. Recently, the "Holiday on Ice" show completed a seven-day engagement to a capacity audience of 30,000, then the ice hockey season opened with an exhibition game between the Cleveland Barons and Indianapolis Caps. The Caps, by the way, were winners of the American Hockey League championship last season. The successful completion of the arena in time for these long-scheduled events is an enviable record as construction of the ice floor wasn't started until August 2. Great credit is due to the ingenuity of construction superintendent N. W. Van Ausdal and his faith in arc welding.

The Hobart Sports Arena is built along the lines of the Cincinnati Gardens. The seating capacity varies with attractions, but permanent chair seats number 4,500. With the folding chair seats, the total seating capacity may be raised to 6,500. Overall measurements are 263 ft long by 200 ft wide and dimensions of the ice floor are 190 by 85 ft. The arena was designed by Freeman Pretzinger, an architect of Dayton, O.

The accompanying pictures show step-by-step construction.

The east half of the floor was used to weld 2,500 lengths of 1¼-in. ID pipe into 256 lengths. These ranged from 163 ft 2 in. long to 191 ft 8 in. The lengths of pipe were butt welded with ⅛-in. E-6010 electrodes and ground flush; then slip couplings were welded over the joint with the same electrodes. Three welds were required for each joint, making a total of 7,500 welds on the 11 miles of piping.

HANDLING 192-FT LENGTHS

Figure 1 shows the special set-up arranged for handling the 192-ft pipes. On each of ten wooden horses there was mounted a special dolly, made by welding brackets to ⅜-in. plate and mounting roller bearings to the brackets. When the pipe rested on these roller bearings, the operator was able to turn the whole long length and do all of the welding in the faster downhand position. To grip the pipe and turn it more easily, he used a special tool. This was made by welding a C-clamp to an 8-in. angle. In Fig. 2 we may see a more detailed view of the pipe, turning dollies and testing trough.

After welding, the next operation was to test the welds. This was done by lifting the 192-ft lengths into a water trough 195 ft long. The trough was made by forming sheet-metal sections and joining them together on the job by arc welding. One end of the pipe section to be tested was capped, and the other end was fitted with a valve assembly and gage. Air to a pressure of 180 psi was then pumped into the pipe. It was easy to spot the leaks as the air bubbled up through the water. Most leaks occurred because of bad sections of pipe; there were less than 10 leaks in the 2,500 welded joints.

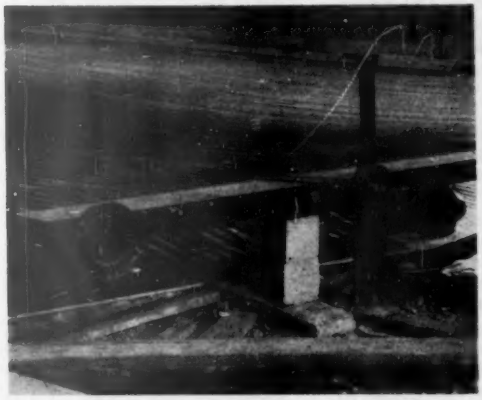
From the testing trough, the pipe was rolled to the floor, later to be welded to the headers. While welding was going on at the east half of the floor, the west half was prepared for the installation of the piping. First a hot asphaltic waterproofing compound was applied to the floor and to edges of glass wool blocks. The blocks were then laid to make the subfloor.

Ground cork was swept over the glass wool blocks and forced into the joints to complete the insulation. Next came more hot asphaltic compound and a double thickness of waterproof paper. All of this completely insulates the ice floor from

(Continued on page 28)

3—CRADLES and reinforcing steel that held welded piping. Note how the pipes rest on cutouts of cradles

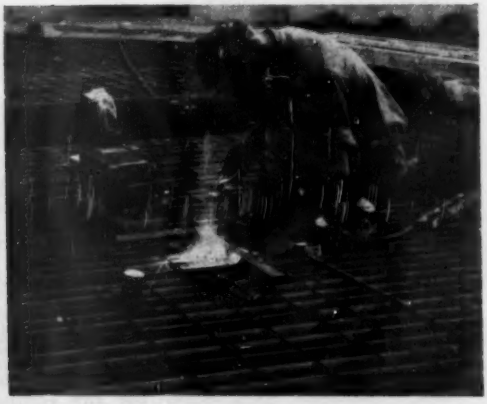
4—WELDING OVERHEAD to attach pipes to header. This job was tough because of the cramped quarters



5—HERE'S HOW piping was jacked up and blocked for operator to weld the underneath sides to header

6—YOU CAN appreciate the weldor's difficulty. No, photo's not upside down; he really is under the pipes

7—REINFORCING STEEL was all welded. It saved time by eliminating fastening by means of wire clips



8—RECEPTACLES for hockey goal posts were also added by welding. So were receptacles for fence posts

Answers to Your

Here's your chance to get expert advice free on your income tax problems. Knowing the answers to the questions printed in heavy type can save you money at tax-paying time. The answers given are authoritative. If you want to avoid overpayments and guard against the taking of deductions that are not allowed (and will lead to penalties and fines), you had better read on.

BY BETTY LEE GOUGH, *Accounting Consultant*

What is the new tax law going to do to me?

It is going to increase your personal income tax rate by roughly 20% for the fourth quarter of 1950 only (except for corporations). The base rate for the lowest bracket is raised from 15% to 18%; other tax brackets are raised in proportion. The fact that you're paying roughly 20% more tax does not mean that 20% of your income is added to your tax. What it does mean is that the *rate* increase is about 20%. Example, that 3% raise from 15% to 18%; 3% is 20% of 15%.

Here is an easy way to figure it: You're back to the rate you paid before the reduction passed by Congress in 1948. The rate applied to each bracket is now the one that held before the last tax rate reduction. That applies to the last quarter of 1950 and will apply to 1951 unless changed later, which appears unlikely.

Is the split income provision out, too?

No; the split income provision of the 1948 law stays in. This provision allows citizens of states without community property laws to "split" the family income for tax purposes, as citizens of the community property states have been doing all along. The advantage of splitting is that, in slicing the adjusted gross income in two, it brings both halves down into lower tax brackets where there is often a considerable saving in the total amount of tax you owe.

Another provision stays in: the $600 (in place of the former $500) personal exemption for yourself and your dependents.

I won a $100 bond as a prize. Must I report it as income?

All prizes count as income. If you had been given a television set as a prize instead of a bond, then the regular market value of the set would have to be reported on the tax return.

My company is run as a partnership. Are there special forms which we must file?

Ask the local Collector of Internal Revenue for Form 1065. This is not an income tax return. But it must be filed to furnish the Collector partnership information against which he can check the individual returns of the partners. Each of the partners must fill out Schedule E on his Form 1040 tax return.

The partners are paid salaries. The rest of the profits remain in the partnership bank account. Do we pay tax only on our salaries?

No. Each partner must report not merely his salary, but his full share of the net profits. Conversely, he can take off his pro rata share of any loss.

Do I have to keep books in any special fashion?

All Uncle Sam demands is that you *do* keeps books and that your books are accurate enough to indicate what his Collectors term "true income."

In setting up depreciation tables for my equipment, how long should I carry them?

For the reasonable "life" of the equipment. One thing may have a life of five years, another fifty. If you put down the true useful life of the piece, Uncle Sam won't quarrel with you.

What taxes may I deduct?

When it comes to business taxes, just about every one is deductible. But not Federal income tax.

For personal deductions by welding engineers who use the long Form 1040, the Treasury notes that "Deductible taxes include state and local income taxes, personal property taxes, real estate taxes and certain sales taxes."

As a rough rule of thumb, the Treasury figures that one-third of your income was spent on items where sales taxes applied—if your city or state levies a sales tax. If you actually shelled out more than this amount of sales tax, keep the receipts to prove it.

Gasoline taxes are deductible as a personal expense except in California, Louisiana, North Dakota, Utah, Wyoming and Hawaii.

How much business overhead may be deducted?

All of it. The Bureau of Internal Revenue allows "reasonable salaries and wages, interest on business indebtedness, taxes on business (including Social Security taxes imposed on the employer) and taxes on business property, losses arising from business operation, bad debts arising from sales and services, depreciation, obsolescence, depletion, rents, repairs *and other expense.*" You can include fees you paid for outside services, commissions, labor,

Income Tax Questions

advertising, even premiums on business insurance. Any legitimate business expense overhead item may be taken off.

May I deduct membership in the American Welding Society?

Where the membership is a business obligation or advantage, dues may be deducted.

How about the cost of subscriptions to business magazines—like THE WELDING ENGINEER?

Take the deduction.

Is there any limit on what constitutes a charity and church contribution?

There is. First off, the beneficiary has to be an organized outfit such as the Boy Scouts, Community Chest, YMCA, church, etc. In general, you can't deduct the value of personal services donated to a cause. Nor can you deduct charitable gifts to an individual. Nor contributions to any political party. Nobody can claim a contributions deduction larger than 15% of the adjusted gross.

Our building burned down. It cost $10,000 ten years ago but was insured for today's value—$15,000. All of the insurance went for a new place. Is the $5,000 "gain" taxable?

In this case, no. Since the money was spent immediately to buy a building of the same true value, there is no tax liability. However, if you had pocketed the $5,000 you "gained" or had purchased something else, you would have to pay Uncle his share.

I sold some corporation securities at a loss. Can I take off the loss?

Yes. Since a welding engineer is not—or at any rate is seldom—in the investment business, any losses may be taken off directly in figuring adjusted gross income.

I rent out an office above my shop. This year, I made some repairs and installed new heating. May I take these expenses off the rent I received?

The repairs may be charged against the rent as a direct expense. But the new heating system is a capital investment and must be "depreciated."

The same rule holds for an engineer who owns a second house and receives rent as non-business income. Expenses of keeping up the house may be charged off to obtain a *net* rent figure.

Can I depreciate the home in which I live?

Not unless you rent out a portion of it. Then part of the expenses and depreciation may be charged against the rent you receive.

May I deduct mortgage interest on my building?

Yes. Also on loans made to purchase equipment, fixtures or even to supply inventory. The same holds true for personal deductions. If you elect to use the long form and itemize your non-business expenses, you can deduct interest on your home, on any personal property such as a car or refrigerator or on a personal note at the bank.

How would I handle mortgage interest on a house I own and rent out?

Since the house produces income, deduct the interest in arriving at a *net* rent received. Be sure to put down the gross income, however. Then figure the net as part of what the tax form calls "adjusted gross income."

During the year, I made an even exchange of common stock in one corporation for stock of another. What does the transaction do to my tax return?

Did you gain or lose on the swap? Check the market quotations of the two stocks at the time the trade was made. If you lost, you can take it off as a capital loss—provided you held the stock longer than six months. If your swap showed a profit, you have to pay tax on the gain.

If the stock you traded had been yours for six months or longer, it is a capital gain. Otherwise, it is regular income.

How does this medical expense business work?

It doesn't, unless you use the long form to itemize personal expenses. Here's the way to figure it:

First, add up all medical expenses. Include not only doctor and hospital bills, but medicines, eyeglasses, hearing aids, crutches, travel to secure medical care not obtainable at home, nursing (the board furnished to a nurse counts as well as her salary), dentists' bills, price of false teeth, hospitalization insurance—anything connected with medical care. Then deduct 5% of your adjusted gross income from the total medical expenses. If there is anything left over, you can claim it, after duly itemizing the expenses and indicating the portion that exceeds 5%.

My insurance is carried in a mutual company. Are the dividends I get back taxable?

No. They do not have to be reported at all. Taxwise, this is a return of income, not an addition to it.

When may I claim a bad debt?

"For a debt to be worthless," the Treasury has pronounced, "it must not only be uncollectable, but must also appear to be uncollectable at any time in the future. Bad debts must be shown to have existed in fact and in law. A taxpayer cannot claim a bad debt deduction if there were no legal liability to pay."

On the tax return, the Treasury Department wants you to list: (1) Nature of the debt. (2) Name of the debtor and his relationship to you if any. (3) When the debt was incurred. (4) When it became due. (5) What you have done to collect it. (6) How you decided it was worthless.

What about a case in which a man pays part of what he owes, and reneges on the rest?

The uncollected portion of the debt may be claimed as a deduction during the year when it became uncollectable.

Last year I wrote off $100 of bad debts on my tax return. This year one of the debtors came across with $50. What must I do about it?

"Bad debts," says the Treasury Department, "are sometimes paid long after the taxpayer has forgotten them. If a deduction had been taken when the debt was written off, the recovery of the

debt is miscellaneous income to the extent of any tax benefit previously secured."

What must I put down to prove travel claims?

The Treasury says: "You are required to attach to your return a statement showing the nature of your business, number of days away from 'home' during the taxable year on account of your business, total amount of expense for meals and lodging and total amount of 'other expenses' incidental to travel."

I have a main shop in the city and another in a nearby small town. Can I deduct travel between the two?

The Treasury says: "Where a professional or business man travels between his principal place of business and a minor place of business in another city, he may deduct the cost of such travel, provided the trips are necessary for the purpose of discharging business at both locations."

When I travel for business, are my meals and hotel rooms deductible?

The Bureau of Internal Revenue not only allows meals and lodgings, but incidental travel expenses as well. Tips are an example.

How about entertainment on a trip?

Your own entertainment is not deductible; *i.e.*, if you take a customer out to a show, your own ticket can't be deducted. When you entertain for business, claim the expense under an entertainment account, not under travel.

I frequently go up to the state capital on business and drive back the same day. Can I deduct this?

The Bureau of Internal Revenue frowns on claiming an expense like this as "travel," but it notes that "the cost of *transportation* (in the case of one-day travel) may be deducted as an ordinary expense of business." Meals and lodging on a one-day trip are living expenses, however, and cannot be claimed.

I use my car part of the time for business, part of the time for pleasure. Are its expenses deductible?

To the extent that it is driven on business trips—yes. First, you determine how much of the mileage is business travel. If you racked up 10,000 miles during the year and 1,500 of them were on business trips, then 15% of the expenses are deductible. Take off 15% of the upkeep, repairs, gasoline and other direct expenses, then charge 15% of the yearly depreciation as a business deduction.

I went to the AWS convention last year. Is this expense counted as business travel?

It is.

Then I stayed on in Chicago a week. How about the hotel expenses?

If you had business in Chicago—yes. Otherwise, no.

My home is in a suburb. I have to drive 18 miles a day to get to work. Can I deduct this, since it is necessary to the earning of an income?

No. Uncle Sam feels that your choice of a home location is for personal reasons. If you want to live in a suburb, the travel to and from home is not a business expense.

BUILDING AN ICE FLOOR

(*Continued from page 24*)

the subfloor. Over the top of the waterproofing paper, pumice was laid to give it a slick surface and to eliminate friction between the paper and the galvanized sheet steel laid over it.

Cradles Hold Piping

The galvanized sheet steel, next applied, allows the entire ice floor (piping, reinforcing, road mesh and concrete) to contract and expand without interference from the subfloor. When it was in place, the workmen rolled the piping across the floor and placed each length in a special welded cradle fabricated of 11-gage steel. The 1,200 cradles, made in a special jig, required over 7,200 welds.

Reinforcing steel was welded to the pipe cradles to hold them in a uniform position to receive the piping. Note the uniformity of the pipes in Fig. 3. This picture shows the cradles and reinforcing steel added to hold additional lengths of piping. The pipes placed are just resting in the cutouts of the cradles.

After all the piping was positioned in the cradles, each section was welded to the header. This was one of the toughest welding operations of the entire job as the weldor had to do half of the welding working in the overhead position in cramped quarters (Fig. 4).

Fig. 5 shows how the piping was jacked up and blocked for the operator to weld the underneath sides of the pipes to the header. The overhead welding was done under adverse conditions. Nevertheless, the absence of leaks showed the skill of the operator and the quality of welding throughout the job. Some idea of the weldor's difficulties may be gained from Fig. 6.

Receptacles for Posts

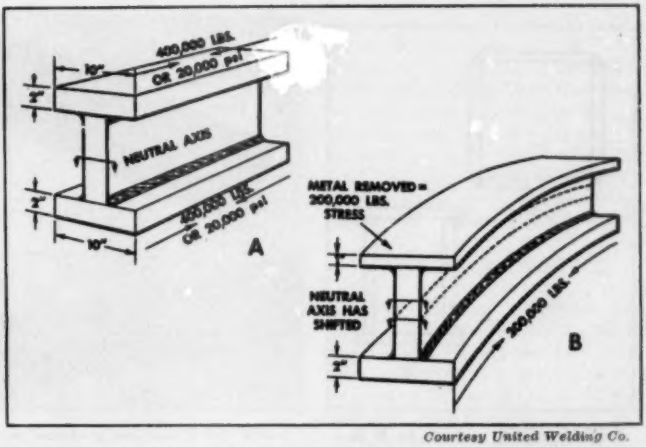
The reinforcing steel for the curbing was welded as in Fig. 7. It saved considerable time as it was almost impossible to reach between the pipes to fasten wire clips. Another good reason for welding the reinforcing steel was the support required for the receptacles for the hockey fence posts. These posts must at times support the weight and force of several hockey players—a good reason for the welding and extra reinforcing. Similar receptacles hold the hockey goal posts. The operator in Fig. 8 is welding in one of the goal post receptacles.

Thanks to welded devices, a 7-in.-thick floor of concrete was poured in record time. One of these, a large dolly, effected great savings in time and manpower. The dolly was a simple framework welded on the job from angles. It elevated the concrete-pouring pipe to a long chute that could be swung from one side of the floor to the other. It was thus easy to place the concrete uniformly without a lot of hand shoveling. As a section of the floor was poured, a length of the pouring pipe in back of the dolly was removed. The dolly was then rolled back along a track made of channels for the pouring of the next section.

The pouring was started at 5 a.m. one day, and the final finishing was completed at 1 a.m. on the next day. This one-piece cement floor is one of the largest continuous concrete placing jobs ever undertaken by the Raleigh Alexander Construction Co. Altogether, 278 cubic yards of concrete were used. The concrete was brought from the plant of the Fenton Construction Co. in ready-mixed concrete trucks.

Courtesy United Welding Co.

1—PARTS CAN often be prebent so that the "distortion" will pull them straight in the final structure



Courtesy United Welding Co.

2—WHY RESIDUAL stresses cause warpage. Both beams have equal and opposite stresses on each side, but on beam B 200,000 lb of the residual stress have been removed from one side by machining. Result: beam bends

Design for Welded Connections—I

If you have anything to do with design, save this article. It tells just what the designer should know about welded fastenings. Economical fabrication needs not only proper design but proper methods for quality control.

BY T. B. JEFFERSON AND W. J. BROOKING*

ENGINEERING must be done in the engineering department, not in the shop. If the engineering staff does the job assigned to its department, the shop will be provided with suitable blueprints and adequate specifications that will eliminate all guess work. All too often, however, these engineering helps are not wholly forthcoming. As a consequence the cost of welded fabrication goes up.

Even with adequate engineering helps, the shop is left with the problem of quality control. Obviously, the joints of a welded structure or machine are important both to the overall efficiency and the cost. Weld strength and other properties must equal or slightly exceed properties of the other elements of the design.

Special control must be exerted so that no more weld metal is deposited than is required for the mechanical strength of the design. Weld metal is expensive material with which to add unnecessary weight. Overwelding also tends to overheat the parent metal and thus weaken and distort the welded joint.

Quality and Fit-up

The spacing of the members of a welded joint a slight distance apart before welding is common practice, especially where 100% fusion is required. A complete metal-to-metal fit-up is seldom practical of attainment, nor is it desirable in most cases. Since weld metal is deposited hot and shrinks in the process of cooling, a small spacing apart gives the members a chance to move with the shrinkage of the weld metal.

For much of the welding undertaken in the manufacture of machinery, ordinary flame-cut edges or rolled shape or plate edges may be considered to be the normal fit-up. Slight irregularities along the edges of flame-cut parts will cause a slight gap of 1/64 to 1/32 in. (or sometimes as much as 1/16 in.), which is desirable.

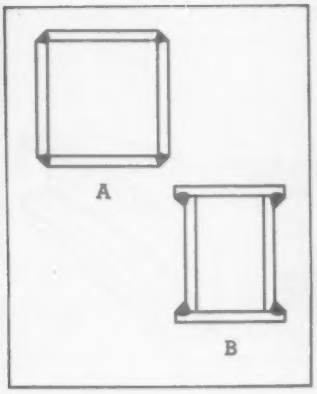
Gaps greater than this normal fit-up of parts are undesirable since weld metal tends to burn through and run away during deposition. To fill such gaps requires the use of a smaller welding electrode and additional cleaning. It also requires the deposition of a larger quantity of weld metal, which is expensive. Because the weld metal is deposited hot and shrinks upon cooling, gaps filled by welding add internal stresses. These tend to distort the welded structure as well as reduce the quality of the welded joint.

The welding operator is sometimes tempted to lay wires called "slugs" (usually a welding electrode with the coating removed) to fill gaps in welded joints. This practice should not be tolerated since the slugs seldom fuse completely into the joint to provide a clean and solid weld.

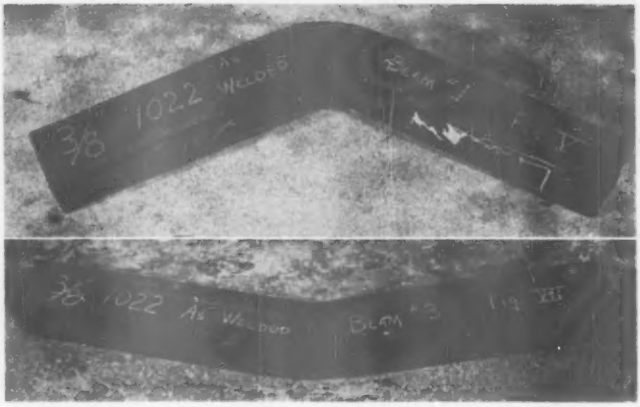
Weld Symbols

Some of the problems of fit-up and overwelding are caused by inadequate information on the drawings. The use of AWS standardized welding symbols provides a convenient shorthand system to convey engin-

*From Chapter 6 of "Introduction to Mechanical Design," a new book published by The Ronald Press, New York City 10.



3—BOX BEAM sections. In B the plates carry load; in A the welds



4—UPPER BEAM had a section of design A; lower beam was of design B. Under the same impact load, the A beam failed while the B beam only bent

eering information regarding welding to the shop. (See THE WELDING ENGINEER's Engineering Data Sheet No. 91, April, 1948.) Properly used, the little arrows and their accompanying symbols on the blueprints tell everything that should be known about the welded joints. For instance—

(a) The location of the weld

(b) Cross-sectional form of the weld

(c) Size of the weld

(d) Length of the weld, or spacing increments for intermittent welds, and increment at the end of the weld

(e) Whether or not the weld is to be made in the shop or as a field erection weld

(f) The type of finish and manner of finishing of the weld

(g) Special information in the form of a reference note in the tail of the arrow may show the type (class) of welding electrodes

(h) Welding machine setting, number of passes and sequence of welds.

The standardized weld symbols provide a common welding engineering language for the design engineer, the welding operator, the inspector and the manufacturing supervisor. They also help to provide a satisfactory control of production.

Internal Stresses

Since weld metal shrinks in cooling, it tends to "pull" the joint members. If T-joint members are free to move and are welded on one side only, a very appreciable distortion will occur by pulling the plate out of line and possibly even breaking tack welds. If the joint members are not free to move, this internal stress is still present. Similar stresses occur in varying degrees in all types of fusion-welded joints.

Stress relief, by heating to 1,000 to 1,200 F for carbon steel, serves to relieve the stresses caused by welding. Stress relief may be mechanical as well as thermal. Peening, for example, is a mechanical working of the weld after it has cooled below 250 F by hammering it with a blunt, air-operated chisel or similar tool to cold forge and mechanically relieve the stress.

Many authorities hold that on multipass welds each succeeding pass tends to relieve the stresses of the previous one. This evidently is true and is probably more effective on carbon-steel structures in which the strength of weld metal usually exceeds the plate strength appreciably and is not affected by alloys absorbed during deposition from the plate.

Distortion of Structures

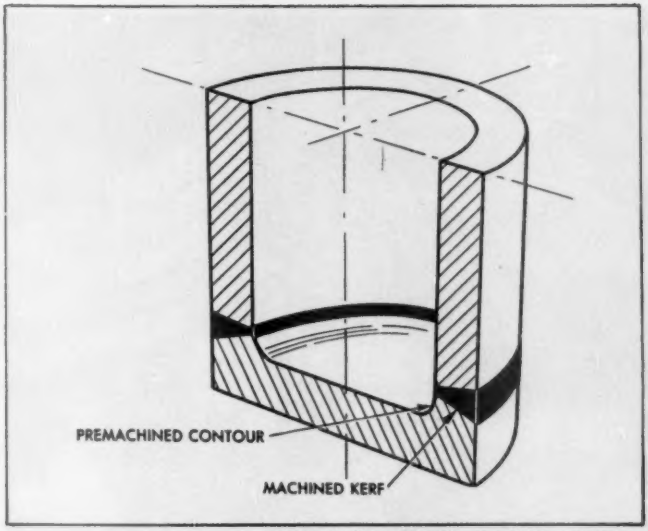
A degree of distortion is to be expected and anticipated by the designer because of welding stresses. If an experimental unit (or a similar unit) has been built, indications as to the extent and direction of distortion from welding will be evident and steps can be taken to minimize the distortion.

Often parts can be prebent so the distortion "pulls" them straight in the final structure as shown in Fig. 1. Another common and effective means is to establish a welding sequence that balances one stress against the other. This prevents most of the distortion that might be brought about by uncontrolled welding sequences.

The design engineer must assume the responsibility for recommending procedures of welding that balance one stress against the other. He should bear it in mind during the design process. Automatic arc welding by the submerged-arc method tends to reduce distortion because of the depth the arc penetrates through the joints and the speed at which it travels. If the structure is one the design engineer can design for automatic welding (and the number to be made makes the process practical), this may be an important means of preventing distortion.

If the structure is designed with the majority of the welding concentrated on one side, or in such a way as to cause the parts to draw, prebending of the main parts on which the welding is to be done effectively prevents distortion. Such bending may be done by clamping the parts in a fixture where they are assembled for welding, or by clamping them separately prior to setting up.

When welded structures are to be machined, the removal of metal may cause a shift in the mass of metal with relation to the residual stresses



Courtesy Lukenweld, Inc., Div. Lukens Steel Co.

5—WHEN CYLINDER is under load, the welds in this cap are in tension. Joint is much stronger than one in which welds are in shear (disc in end)

set up by welding so that the structure becomes distorted after machining (Fig. 2). Planning to avoid such warping should be given careful study. If such structures are stress relieved before machining, this will eliminate the residual stresses and prevent later distortion upon machining.

The most outstanding characteristic of arc-welded design is the high efficiency of its joints and therefore the rigidity of the welded structure. An extremely high degree of rigidity may be obtained by properly distributing stiffening sections and fusing them to load-carrying members of a structure.

Because of the rigidity of welded structure, welding design theory holds that the weld metal should have characteristics duplicating the parent metal as nearly as possible. The weld should be equal to or slightly greater than the strength of the parent metal in tensile strength and elongation. It should not greatly exceed the tensile strength of the parent metal, particularly if it becomes more brittle (has less elongation than the parent metal). Loads are seldom thrust on members of a machine gradually or equally. A brittle weld may be stressed beyond its yield point and shatter, thus causing the structure to rupture and fail, whereas a slightly lower tensile weld with a slightly greater elongation will yield a little and distribute the stress throughout the rest of the welds in the structure and thence to the load-carrying members of the unit without approaching a point of failure.

Stresses and Structures

The transmission of stresses throughout a welded structure is of considerable importance; in particular the way in which loads are transmitted through welded joints is of prime importance. The so-called reinforcement of the weld above the surface of the plate is not a reinforcement but instead is a stress-concentrating element and detrimental. With less "reinforcement," the stress flow is more uniform and the stress concentrations are not so acute as in the one with the greater reinforcement. For this reason, butt welds should be made as near flush with the top of the plate as possible. However, no groove should be allowed to exist at the juncture of the weld metal and the plate since this would be an even more violent concentrator of stresses.

It is seldom necessary for the weld metal in a joint to be placed in a position where it carries the full load in a structure. This is particularly true of all welds except butt welds where the cross section of the weld metal is in direct line with the plane of the plate and the same thickness. In most designs it is possible to place the weld in such a position as to hold the parts together but to make the load transfer from one member to the other without throwing the full load on the welded joint.

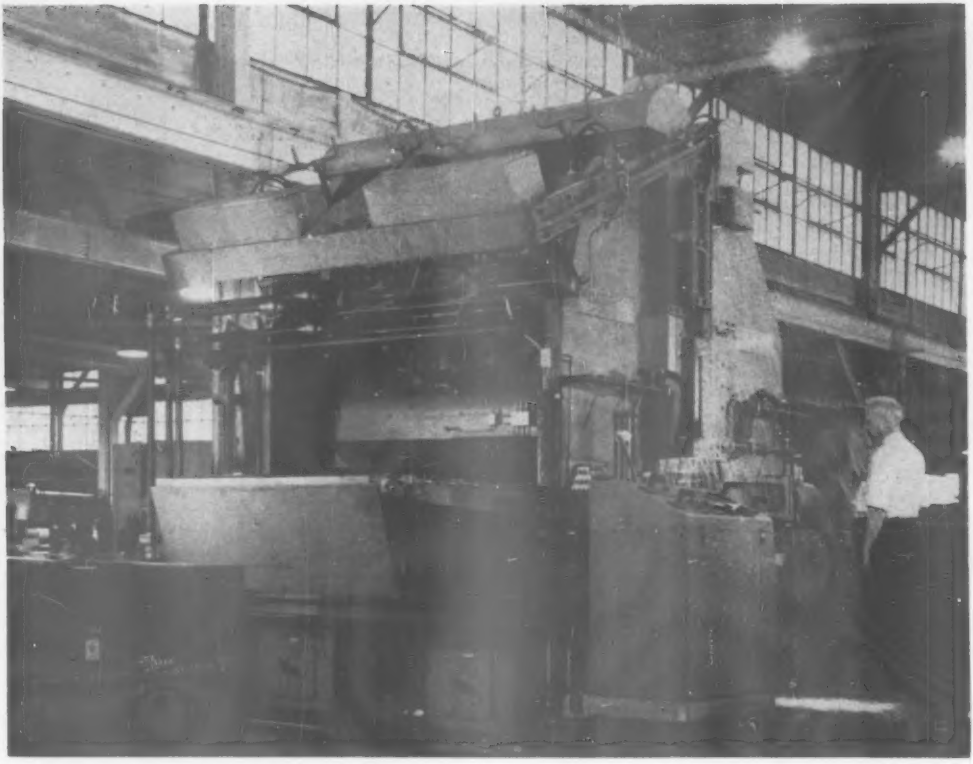
How to Design a Box Beam

Sketch A of Fig. 3 illustrates the placing of the weld metal in such a position as to carry much of the load when subjected to bending loading, whereas in B the members of the structure carry the load; in B the welds serve as wedgelike joining devices and not as load-carrying elements. Fig. 4 shows actual tests of box sections welded as shown in Fig. 3. They were tested under very heavy impact bending loads. Note that the type of construction illustrated by A failed by rupturing through the weld, whereas the design of B bent but did not rupture the weld. The same principle applied to capping a cylindrical member is shown in Fig. 5. In this case, the weld is in compression or tension rather than acting as a wedge or being placed in shear, as it would be if a flat disc had been welded into the end of the cylinder to make the closure.

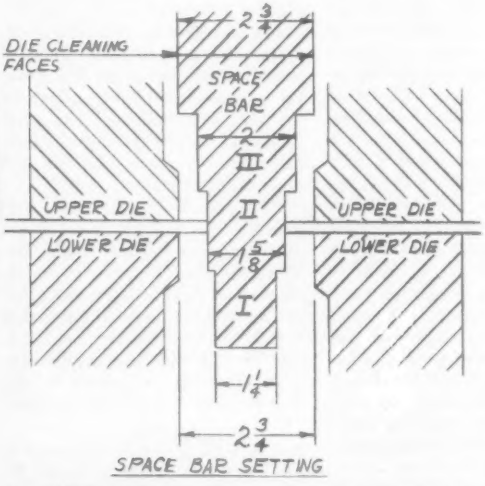
This principle of the use of weld metal as a key or wedgelike joining member instead of a total stress carrier is important in all welded joints. It provides an additional factor of safety to take care of possible operator or manufacturing imperfections that may be encountered because of conditions beyond the control of the manufacturer, such as imperfect steel or irregular electrodes.

Electrodes having a lower yield strength than the parent metal are often used, especially in welding low-alloy, high-tensile steels or certain alloy steels. Here it is especially important that the metal be distributed to hold the joint together but not to take the full load. This applies even when the welds are greater in size than the section of the parent plate.

Part II, to be published next month in THE WELDING ENGINEER, will cover design to save weld metal, maintenance of close tolerances, material and space economy of welded fastenings, strength of weld metal and effects of external stresses upon weld joints.



1—ACTION SHOT of 600-kva strip welder undergoing test. This flash-butt welder can join strip up to 62 in. wide. Hydraulically operated clamps exert force up to 500,000 lb. Forging or upset force is 175,000 lb



2—SCHEMATIC drawing of gage bar shows different widths for welding various thicknesses of strip. Carrying hardened cleaner blocks, the gage bar can also "double in brass" by cleaning flash from die surfaces

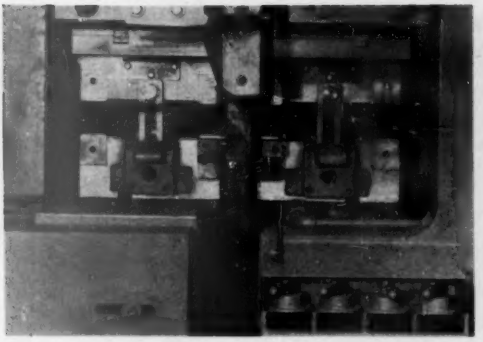
Flash Welding Steel Strip

Among the many advantages of a new 600-kva welder for strip is a system for automatic gaging according to the thickness.

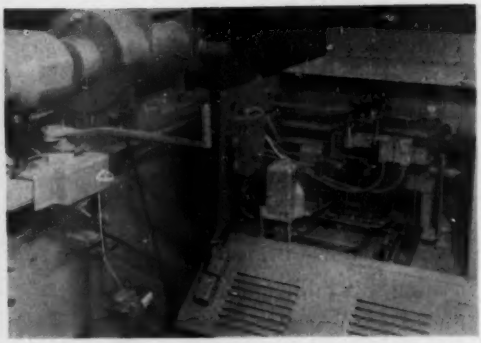
WHERE continuous strip is desired, as in the production of tubing, there must be some way of welding the ends of coils together just about as fast as they can be fed. The best method yet found to use in production lines is the flash-butt welder.

The 600-kva welder shown in operation in Fig. 1 is the second of two 62-in. flash-butt welders ordered for a strip mill designed by the Wean Engineering Co., Warren, O. A third welder of this type was under construction at the present writing.

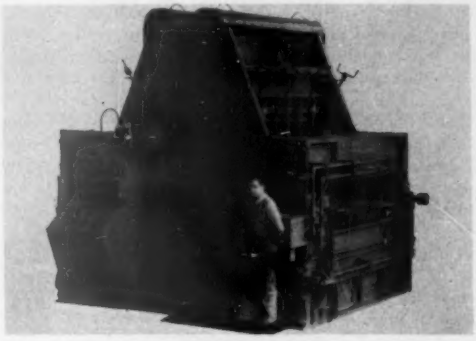
Among the many special features embodied by this welder is a system for automatically gaging the amount



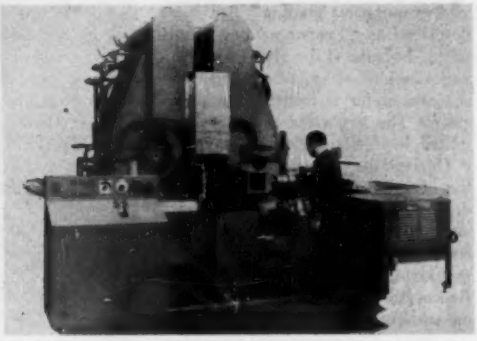
3—FRONT VIEW shows gage-and-die-cleaning bar in down position at the time of locating the strip ends



4—SERVO-MECHANISM on right takes over and completes weld cycle, started by hand lever at the left



5—A 900-KVA strip welder designed to flash weld the ends of strip up to 3/16 in. thick by 84 in. wide



6—STRIP up to 24 in. wide can be welded on this 400-kva welder. Maximum clamping force is 140,000 lb

of strip protruding from the dies according to the thickness of material. This is done preparatory to welding. Fig. 2 (drawing) shows an end view of the gage bar indicating the different distances, I, II and III, between the ends of the strip. The particular width of the space bar is selected according to the thickness of the material that is to be welded.

Figure 3 (photo) is an end view of the gage bar at the time of locating the ends of the strip. Bar is in the down position. When bar is withdrawn, the ends of the strip move slightly away from it to prevent them from becoming bent. The gage bar also carries hardened cleaner blocks to remove the flash adhering to the vertical surfaces of the dies.

Before welding, the ends of the strip are matched by special air-operated matching guides. These guides locate the strip and are then withdrawn before clamping. The strip does not run against them, practically eliminating guide wear.

The strip ends are clamped across their full width by hydraulic clamps, operating under a force up to approximately 500,000 lb. The clamps are designed so that no excessive pressure is exerted on the copper-alloy portion of the dies.

Fig. 4 shows the automatic servo-mechanism, also hydraulically operated. The welding operator starts the cycle by means of the hand lever in the center of this picture. Once he has started the cycle, the servo-mechanism takes over and completes the weld. The operator can exercise full control at any time, even to reversing the action. If he does not exercise this option, however, the welding cycle—flashing and forging action—is fully automatic. The servo-mechanism controls the burn-off and upset. This particular 62-in. welder has a forging force of 175,000 lb.

Die changing has been made rapid and comparatively simple by means of special die holders. Air blast nozzles on the die holders keep both die and strip clean of flash, a most important feature for longer die life. The dies are adjusted as they wear, and three quarters of a die may be used up before it needs replacement.

Similar welders are built for strip ranging in width up to 100 in. Figure 5 shows a 900-kva, 84-in. strip welder designed to weld 3/16-in.-thick strip 84 in. wide. The maximum upset force is 150,000 lb, and the maximum clamping force is 425,000 lb.

In Fig. 6 is a 400-kva strip welder that can handle strip up to a maximum width of 24 in. The maximum upset force is 50,000 lb, and maximum clamping force is 140,000 lb.

Photos courtesy of The Taylor Winfield Corp.

Maybe there's a use you can find for

Vapor Welding

A bell jar and a vacuum pump are needed if you want to do this specialized form of metallizing. Advantages are: (1) you can control the thickness of the coating to a millionth of an inch and (2) coating needs no finishing. You can also spray a metal coating on paper.

BY THOMAS A. DICKINSON

THE process officially known as "evaporation coating" has been described as a "vapor-welding" technique because it involves the heat-vaporization of metals, much the same as water is heated to produce steam. The vaporized metal is then united by fusion to other materials.

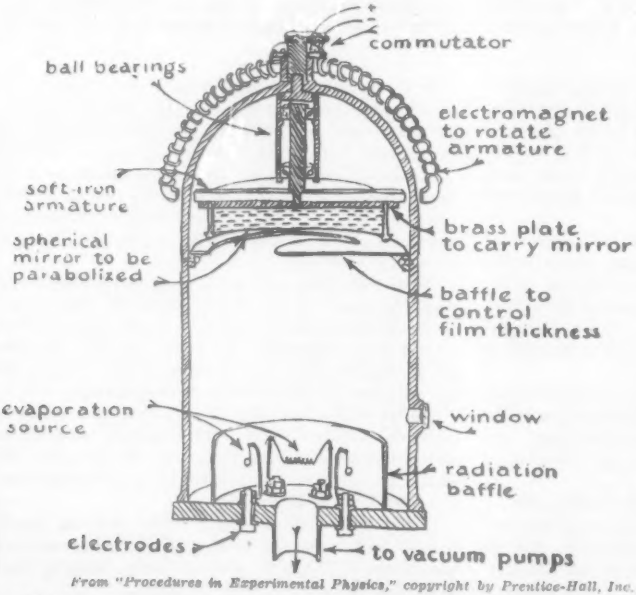
During the vaporization process, the metallic materials are broken down into molecular particles of minute dimensions; for this reason the fusion of metal vapors on deposition materials involves very little heat. Hence metallic coatings can be built up without damage on paper, wax, wood and inflammable plastics as well as on other metals.

Coatings can be built up with dimensional precision to depths ranging upward from a millionth of an inch. Surfaces are as smooth as electroplated surfaces. Yet, because the evaporation process permits the fusion of minute particles, the bonds between deposition metals and other materials may have greater strength than the bonds produced by any other metallizing process.

Some Coatings Transparent

Vapor coatings may be so extremely thin as to appear transparent; they have in several cases been used on optical products such as photographic lenses to improve the abilities of glass and other transparent materials to transmit light. When comparatively thick, evaporation coatings have a bright metallic luster and are used on both metallic and non-metallic surfaces. Surfaces that can't be readily electroplated (due to electrochemical incompatibility) may be evaporation coated to prevent corrosion, increase surface hardness, improve electrical properties, etc.

Current for evaporation coating can be obtained from the same power sources used for a-c welding, at ranges of 1-135 volts, 5-400 amp. Output terminals for the power source are usually attached to the terminals of the tungsten coil or filament heating the metal to be evaporated.



From "Procedures in Experimental Physics," copyright by Prentice-Hall, Inc.

DIAGRAM of a vacuum chamber, showing the elements essential to evaporation coating. Electromagnet enables object coated to be moved from outside

A Vacuum, Then Inert Gas

The big difference between evaporation coating and ordinary metallizing is that in the evaporation process the heating element is situated in a vacuum chamber. Prior to each heating operation, air is evacuated from the chamber (for an ultimate vacuum of 1×10^{-4} to 5×10^{-6} mm of mercury). As a rule, an inert gas (argon, helium or nitrogen) is then pumped into the chamber to make sure the metal vapor is deposited without oxidation.

Products to which evaporation coatings will be applied are immaculately cleaned and mounted within the vacuum chamber on special fixtures. Sometimes all surfaces of an object are simultaneously coated; in other circumstances, certain areas must be masked or shielded so that they will not be coated.

Dr. John Strong, who conducted the initial experiments at the California Institute of Technology several years ago, is generally credited with having brought the development of evaporation coating techniques to a state of commercial practicability. Dr. Strong's reports indicate that 27 chemical elements can

EVAPORATION-COATING equipment of a large-scale type is now used in, routine production work by companies such as Ray Campbell of Los Angeles

Table I.
Evaporation Temperatures

Material	*Temperature at 10^{-5} mm Hg, deg F*
Mercury	117
Cesium	320
Rubidium	350
Potassium	405
Cadmium	514
Sodium	557
Zinc	662
Magnesium	822
Strontium	1,000
Lithium	1,018
Calcium	1,121
Barium	1,170
Bismuth	1,184
Antimony	1,292
Lead	1,341
Tin	1,607
Chromium	1,683
Silver	1,915
Gold	2,141
Aluminum	2,170
Copper	2,316
Iron	2,590
Nickel	2,631
Platinum	3,738
Molybdenum	4,499
Carbon	4,571
Tungsten	5,850

be satisfactorily vaporized for deposition purposes at the temperatures given in Table 1*.

Handling from Outside

These values do not agree with melting points: most evaporation materials will melt before vaporizing. Surface tension, however, prevents the escape of heated materials prior to vaporization. The usual method of heating, as cited by Strong (p. 171), is to surround the metal to be evaporated by a helix or coil of tungsten wire. Baffles may be installed in the coating chamber (see sketch) to focus or concentrate vaporized substances for deposition in certain areas. By using soft-iron fixtures for the support of products to be coated, you can employ an electromagnet outside of the vacuum chamber to alter the position of the fixture and its load during the coating process.

In addition to the 27 elements previously mentioned, some alloys and a number of metallic salts can be vaporized for coating purposes. Most practical, however, for a majority of current applications are aluminum, gold, silver, chromium, zinc and nickel—mostly materials of extreme chemical inertness.

A few materials cannot be evaporation coated because of the low vapor pressures that are essential in this type of work, but these are the exceptions—not the rule.

As for practical examples, consider the manufacture of phonograph records. Wax and plastic masters are thinly evaporation coated so that they will have the electrical conductivity required to electroform production dies thereon. Also piezoelectric crystals—quartz, ceramic, etc.—have been metallized with evaporation equipment so that their electrification can be preserved without varying their fundamental vibrational frequencies. Piezoelectric crystals are used in phonograph pick-ups, radio-television equipment, ultrasonic transducers, etc.

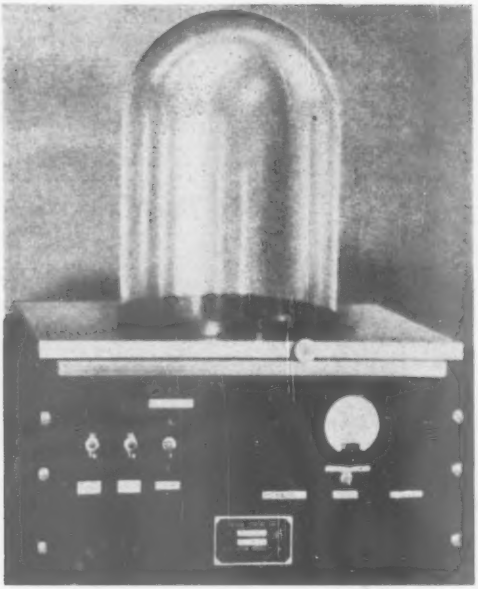
Sheets of waxed paper, evaporation coated with aluminum or zinc, are now being laminated as condensers for all types of electrical equipment; this has greatly reduced condenser production costs.

Transparent evaporation coatings with thicknesses of about 0.000,005 in. are normally used on optical materials, as before explained. Opaque aluminum coatings, however, are frequently preferable in the fabrication of first-quality reflectors for telescopes and similar instruments because they can be evaporated for optimum reflectiveness with less difficulty than could be anticipated in using other metallizing techniques—such as the classic chemical-reduction process of "silvering" mirrors.

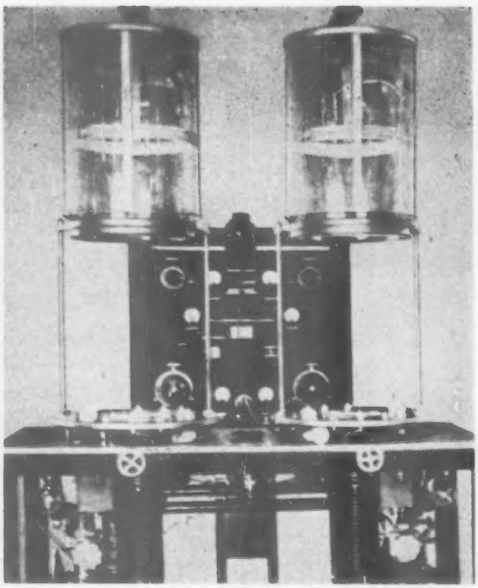
Metallized Paper

Opaque evaporation coatings have also been used on wood, paper, fabrics, leather, etc., for special decorative effects. Paper thus metallized

*Original figures, given in absolute temperatures, were converted to Fahrenheit.



SMALL-SIZE experimental unit may also be used for production evaporation coating on a very small scale



TWO-CHAMBER evaporation unit will enable a continuous production in the metal coating of small objects

has the appearance of metal foil; yet it can be cut, used as printing stock and otherwise handled or processed without acquiring the wrinkles and creases that would characterize metal foils. Incidentally, it is interesting to note, a single ounce of aluminum can be evaporated to provide an opaque coating for more than 3,000 square feet of paper stock.

Equipment Available

Commercial equipment for evaporation coating is now available through a number of concerns—such as F. J. Stokes Machine Co., Philadelphia; National Research Corp., Cambridge, Mass.; and Distillation Products, Inc., Rochester, N. Y. However, it seems rather likely that many companies with modern welding equipment can—for experimental purposes, at any rate—utilize the evaporation process without a considerable investment in new equipment. The principal cost of such equipment is due to the cost of a power supply and pumping accessories.

Bell jars suitable for use as vacuum chambers can be obtained from dealers in scientific equipment in most cities; tungsten heating coils are purchaseable in many hardware stores; and gases of the types used in inert-arc welding can be used and reclaimed many times for coating purposes.

Related Coating Processes

Evaporation coating is closely related to the cathode sputtering process, in which high-voltage current flows between two electrodes in a vacuum chamber. The electrode materials are deposited on different surfaces (such as the plates used in selenium rectifiers). Coatings produced by cathode sputtering, however, are usually quite rough and invariably opaque.

Other metallizing techniques—including the well-known metal spraying and electroplating processes—may be regarded as superior to the evaporation process from a strict time-and-cost production viewpoint since they permit the application of metals with comparative speed and relatively simple equipment. But even when the special properties of evaporation coatings are non-essential, most metallizing techniques are deceptively expensive because they necessitate supplementary processing. Electroplated coatings must usually be buffed for a bright finish and lacquered to prevent tarnishing; while alloy-spray coatings may require considerable wire-brushing, polishing, machining, etc.

Evaporation coatings usually require at least an hour of application time, due to the need for pumping operations for each production run. If a sufficiently large vacuum chamber is used, however, large quantities of articles can be vapor coated during each production operation. In most cases, the finished products require no supplementary processing (insofar as the coatings are concerned) after they are removed from the vacuum chamber.

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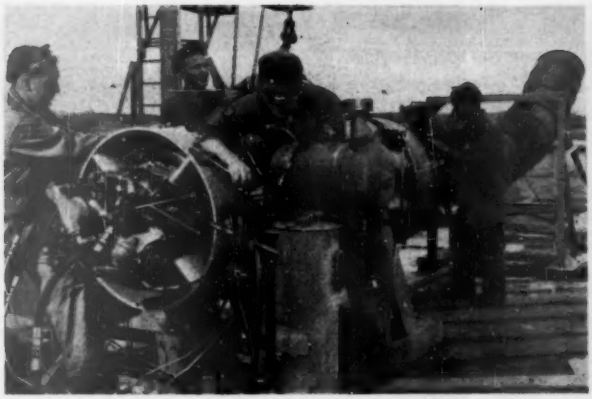


TEST STAND welded from scrap parts holds jet engine at Hamilton Field. Exhaust deflector (right) of welded oil drums protects crew

CPL. FLOYD OLSON checks final run-out figures on overhauled J-35 turbojet

It Keeps Jets Flying

BY ALAN D. CLINE

Technical Sergeant,
Hamilton Air Force Base

SALVAGED steel tubing and spare accessories were welded into an efficient stand for testing jet engines at Hamilton Air Force Base, Hamilton, Calif. The stand was entirely built at the base as part of Hamilton's successful experiment in J-35 jet engine overhaul at the base maintenance level.

Saves Engine Shipment

Previous to this experiment, all jet engines needing other than very minor maintenance had to be elaborately packed and boxed for shipment back to an Air Force repair depot. Airplanes in service overseas or at outlying bases were sometimes grounded all the while that engines traveled back and forth from a United States repair depot or a rear area.

Now the time that used to be spent in packing and boxing, shipping, unpacking and assembling is put to better use in actual repair at Hamilton. This operation not only saves the Air Force an estimated $150,000 per month but has apparently helped efforts to increase working life of the J-35s between overhauls. At the program's start, engines averaged about 50 hours before being pulled from F-84 "Thunderjet" fighters for maintenance. Now the average for Hamilton-maintained J-35s is nearly 200 hours; two engines have passed the 500-hour mark.

Overhaul and repair is done by specially trained men of the engine build-up section of the base maintenance squadron. These men were schooled at a jet repair depot. After doing minor repairs at Hamilton at the start of the experiment, they now repair or replace component parts of the aft or "hot" section that must be fitted to a tolerance of a thousandth of an inch.

Of primary importance to the overhaul is the tough test every turbojet must pass on the base's home-made welded test stand. Stand testing shows up loose connections, assembly errors and other slip-ups. In addition to repaired engines, all factory-new J-35s are run in on the stand.

Base of the stand is heavy gage welded plate fabricated into U-sections, in turn welded into a sturdy box frame. Cross braces and diagonals keep it rigid. Though turbojets don't vibrate like piston engines, rigidity is essential for the stand's fuel and pressure attachments. Tanks, hose fitting and other connecting apparatus are welded right onto the stand for handiness.

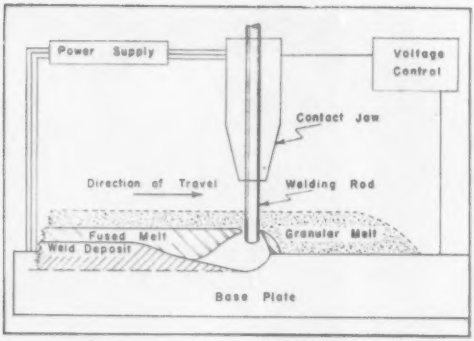
Exhausts Into Oil Drums

So that mechanics can't possibly be burned by the searing hot gases from the engines on the test stand, an exhaust deflector (far right in photo) was welded from 50-gal oil drums. Jet gases are pretty hard on the drums, but replacement is no problem considering the quantities of oil and gas used on an airfield.

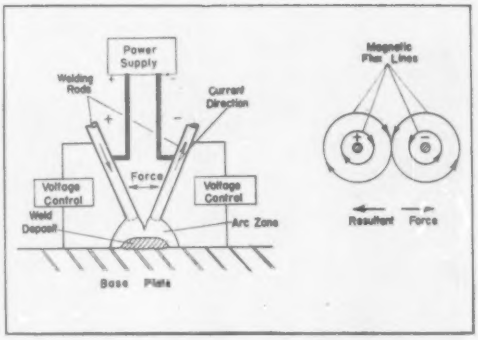
Welding figures in special tools for installing combustion chambers in the J-35s. One is constructed from swaged parts, scrap tubing, strap iron and a toggle lever. The toggle and a push rod firmly hold the chamber while it is exactingly fitted into place. For holding compressor sections and rotor shafts in line with the axis of the engines, a special L-shaped welded hanger serves well. With a chain hoist, this hanger holds the parts in alignment and saves much time.

Once thought impractical for operational flying fields, jet engine overhaul by base maintenance squadrons has proved itself at Hamilton. Success of the J-35 repair program is attested by the frequent requests of pilots for Hamilton-maintained engines in preference to factory-new engines. Confidence and morale has been built to a new high among squadron personnel, engineering officers and the men of the engine build-up section.

Some of our repair methods and welded jigs have proved out so well that they are being copied for use by the entire Air Force and also by the engine factory.



1—CONVENTIONAL submerged-arc welding with work in the circuit. Note location of rod tip and weld pool



2—SERIES-ARC welding. Bead has only slight penetration. Sketch at right shows flux fields around rods

Series- Arc Welding*

New method of submerged-arc welding hooks up the electrodes in series so the work isn't a part of the welding circuit. This technique offers great possibilities for surfacing or cladding where low dilution is essential.

BY A. R. LYTLE and E. L. FROST

Union Carbide and Carbon Research Laboratories, Inc.

As SUBMERGED-ARC welding is conventionally employed, heavy currents are used to produce sound welds of deep penetration. However, there are certain applications where shallow penetration of the weld bead is more desirable. Production of composite structures, such as stainless-clad assemblies for the chemical industry and similar corrosive services, are typical of such welding applications.

Presently accepted techniques for producing the desired results on this class of work involve low speeds of travel and low welding currents with relatively high arc voltages. With these modified techniques, dilution values as low as 20% may be obtained in single-layer deposits; that is to say, 20% by volume of the fused metal consists of base plate and the remaining 80% deposited metal.

The Old Way and the New

The new method we are about to describe can consistently produce dilution values less than 10%, in some cases as low as 1.5%.

Let's consider the basic reactions within the welding zone under normal submerged-arc welding techniques. What's immediately apparent is that a large volume of parent metal is fused. Figure 1, a diagrammatic sketch of the welding zone, shows the location of the tip of the rod and the weld pool with respect to the surface of the parent metal.

Within practical operating limits, weld penetration is an inverse function of arc voltage and a direct function of welding current and travel speed. You use a higher voltage but lower amperage to get less penetration (and less dilution). Present cladding and surfacing techniques involving deposits of differing alloys (where dilution should be avoided as much as possible) employ currents of 175 to 300 amp, low travel speeds (4 to 6 ipm) and relatively high welding voltages (37 to 40 volts). A number of tests indicate that dilution values in a single layer reach a minimum of approximately 20%.

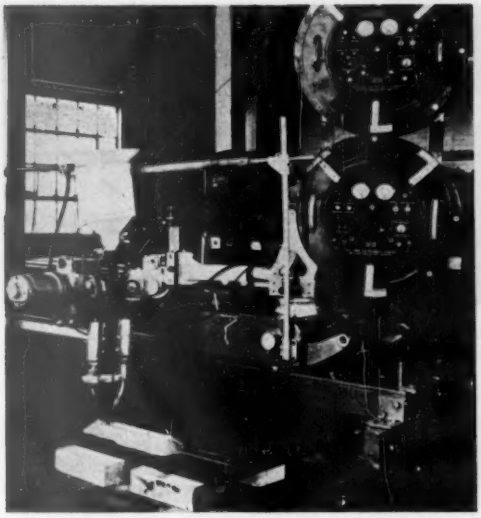
Our new method (Fig. 2) provides a means of drastically reducing the penetrating effect of the welding arc. The basic principle is to maintain a welding action in which the welding current is completely independent electrically of the base plate material. Heat from the welding puddle fuses a thin layer of base material instead of a deep layer.

It's done by employing two (or possibly more) converging welding rods connected electrically in series so that the current flows from one to another. The base plate (work) is electrically insulated from the power source instead of being grounded. The welding current flows from one rod through the welding zone and back through the other rod to the power source to complete the so-called "series-arc" circuit. Location of the welding zone is readily adjusted by proper positioning of the rods to control the heat input to the base plate.

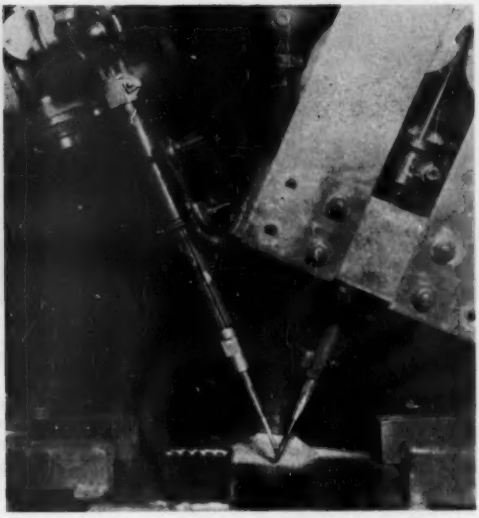
Arc Fans Out

In series-arc welding, when using either an alternating or direct current power supply, the instantaneous polarity and direction of current flow through each of the rods are opposite. This condition creates a repulsion between the rods that tends to deflect the arc stream outwardly. The net result is a fanning-out or spreading of the arc zone. Normally, the

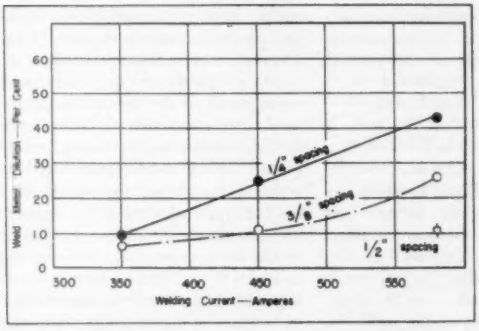
*Abstract of a paper presented at annual meeting, American Welding Society, Chicago, Oct. 25, 1950.



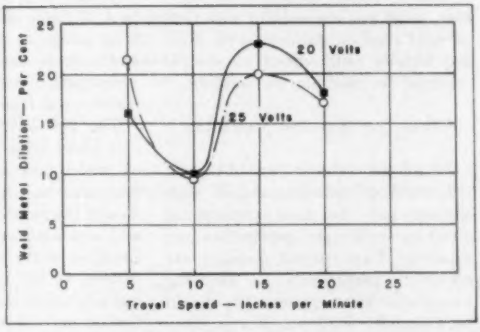
3—TWO WELDING HEADS and their voltage controls are mounted on one carriage to do series-arc welding



4—CLOSE-UP of weld zone without flux. Rods intersect above base plate. Travel was away from the camera



5—HOW POSITION of welding rods affects dilution of deposit at given current is shown by these curves



6—EFFECT OF travel speed on the dilution of weld metal for 20 and 25 volts, the most acceptable range

welding rods are positioned in a plane lying across the direction of travel during welding, so the spreading effect results in a wide, thin weld deposit. Right-hand sketch in Fig. 2 illustrates the flux fields and the resultant forces that surround two electrical conductors connected in series with the power supply.

Of course, more than two welding rods can be introduced into this series system. They can be arranged, if you wish, to form an interlocking pattern of diverging weld zones. That will produce wider beads than can be obtained by a single pair of electrodes.

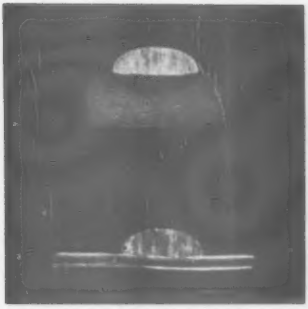
To give a brief description of the equipment, each rod is independently fed by its own motor and voltage control system through insulated contact jaws. Any of the commonly used submerged-arc welding heads are suitable.

Power cables are connected directly to the busbars of each welding head in such a manner that the power supply is in series electrically with the two rods. Under these conditions, the base plate should be electrically insulated from the welding system. The location and positioning of the converging welding rods are regulated so that a common puddle is formed between the rods.

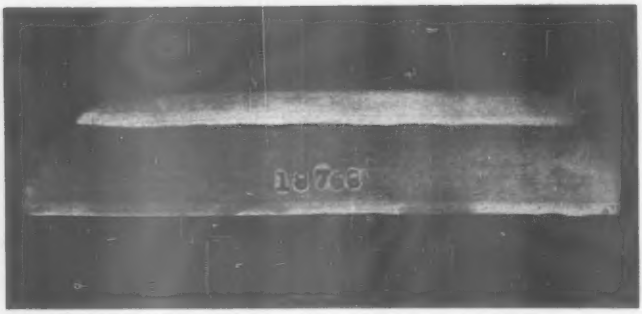
Voltage control leads are connected between each welding head and the base plate; the potential measured between these two points is used to regulate the rate at which the welding rods are fed into the welding zone.

Fig. 3 is a general view of a two-head installation, employing a submerged-arc welder that can be used with either direct or alternating current. A simple jig is used to interlock the contact assemblies. This equipment can be readily modified for tandem welding, or the welding heads disengaged for separate operation.

A close-up of the welding zone appears in Fig. 4. The rods (normally covered by the granular welding com-



7—STAINLESS deposits laid on steel plates of ⅛ and 7/16 in.



8—MULTIPLE BEADS of high-conductivity copper on a mild-steel base plate. Note shallow penetration. Table II gives composition of deposit

position shown in the background) intersect above the surface of the base plate. A typical multiple-layer weld deposit is also pictured. The smooth overlapping of beads produces a clean weld surface.

Either alternating or direct current can be used with this technique. Alternating current is preferred, however, when you are welding with rods of mild steel or stainless steel. With non-ferrous rods, direct current is essential to maintain the welding.

Effect of Welding Variables

Of all the welding variables studied, welding current and rod positioning had the most pronounced effect on weld metal penetration and dilution. Low current densities are required, particularly in cladding operations, where penetration should be especially shallow. For a given rod size, the welding current should be reduced to a minimum consistent with acceptable voltage stability. If you use 3/16-in. rods in each welding head, the welding current may range from 350 to 450 amp, and the intersection of the rods should be located from ¼ in. to ⅜ in. above the surface of the base plate. For applications where penetration is not of primary importance, higher currents can be used. Note the new variable: the position of rod intersection or rod spacing.

From what we have said of normal submerged-arc technique, you might deduce relatively high voltages between each rod and the base plate would be desirable to maintain low penetration and dilution. This is not true. The most acceptable voltage range was found to be from 20 to 25 volts, and erratic and unstable operation was observed in most cases when the potential exceeded 30 volts.

Travel and Rod Positions

The speed of travel during welding influences the position of the tips of the rods with respect to the molten pool of metal. The satisfactory operating range is quite wide, however, and a large amount of the present investigation was conducted at a travel speed from 10 to 15 ipm.

The best location for the rods is in a plane lying across the direction of travel and perpendicular to the workpiece and welding direction. A 45-deg included angle seemed best and was used in subsequent studies. Location of the rod intersection with respect to the surface of the work has a pronounced effect on the penetration and dilution of the weld. As the distance of the intersection is raised, there is a gradual narrowing of the weld and a marked decrease in dilution. Increase the spacing still further, and you'll get a weld having heavily rounded edges, sometimes with intermittent or no penetration into the parent metal.

The position of rod intersection or rod spacing (as it will be called from now on) does not influence the level of the welding control voltage. Deposits have been made at potentials of from 22 to 25 volts with rod spacings ranging from ⅛ to ⅞ in.

Figure 5 shows the effect of different spacings, for any given amperage, upon weld metal dilution. Figure 6 correlates travel speeds for two different voltages with dilution. All these data apply to welds made with mild-steel welding rods; some minor variations develop when welding with high-alloy or non-ferrous metals because of the large differences in electrical and thermal properties of the metals.

To demonstrate the low dilution and penetration obtainable with this technique, single-bead deposits were made with a stainless steel rod on copper-backed, 11-gage (⅛-in. thick) and 7/16-in. mild-steel base plates. Typical cross sections from these deposits are shown in Fig. 7. The maximum depth of the penetration measured over a number of sections was 0.04 in. below the surface of either plate. Under normal submerged-arc welding conditions, this would be a difficult type of deposit to make in the 11-gage steel and the penetration would be greater than 50% on the 7/16-in. plate. The economic advantage gained by the series-arc method of welding is considerable since only a small amount of energy is consumed in fusing the base plate and the large proportion of heat within the welding zone is used for melting the welding rods.

Cladding with Stainless

Where metal parts or assemblies are subject to corrosive attack and require the use of high-alloy stainless steels, it is frequently possible to realize a considerable saving in production. With the new technique, you can employ plain carbon or low-alloy steel for the main body of the structure and confine the more expensive corrosion-resistant metal to the zone exposed to the corrosive media. Welded fabrication of such assemblies as chemical reaction tanks and facings on large valve parts are

typical of such clad structures. Because of the unusually low dilution that may be obtained with the series-arc welding technique, the weld metal closely approaches the chemical and physical properties of the welding rod selected for the particular application.

Table I gives chemical compositions of weld deposits made with different types of stainless-steel rods. In all cases, the base plate was 7/16 in. thick and of mild steel containing 0.24% carbon. This table shows that the total chromium loss is frequently greater than that of the other elements. Nickel, however, transfers across the welding zone with substantially no loss. Hence a fairly accurate measurement of dilution may be obtained by comparing the amount of nickel in the weld deposit and in the welding rod. By this criterion, the weld made with type 310 welding rod had a dilution of 9.9%. Excellent corrosion resistance was observed in all-weld-metal specimens when tested with a 65% concentration of boiling nitric acid. These specimens were prepared from type 347 deposit produced by the series-arc technique.

Figure 9 illustrates the rate of deposition at several current levels for various metals employed with the series-arc technique. For comparison, curves are plotted for the conventional single-electrode, work-in-circuit technique with both mild steel and stainless.

Table I. Chemical Composition of Series-Arc Stainless Deposits

	Stainless Type	% C	% Cr	% Ni	% Mn	% Si	% Cb
Welding rod	309	0.084	24.30	13.68	1.88	0.47	...
Weld metal—1st layer..	"	0.12	21.92	13.18	1.81	0.81	...
Weld metal—2nd layer..	"	0.12	22.87	13.53	1.81	0.83	...
Welding rod	309 SCb	0.076	22.58	14.33	...	...	0.82
Weld metal—1st layer..	" "	0.12	19.83	12.94	...	...	0.52
Welding rod	310	0.16	25.22	20.14	...	...	...
Weld metal—1st layer..	"	0.16	21.97	17.80	...	...	...
Weld metal—2nd layer..	"	0.15	23.91	19.30	...	...	...
Welding rod	310	0.15	25.70	20.02	1.72	0.42	...
Weld metal—1st layer..	"	0.17	21.60	18.02	1.76	0.73	...
Welding rod	304	0.056	20.75	10.15	2.14	0.18	...
Weld metal—2nd layer..	"	0.086	20.10	11.93	1.88	0.59	...
Weld metal—3rd layer..	"	0.074	19.54	10.63	1.97	0.56	...
Welding rod	347	0.064	19.79	11.48	2.34	0.049	1.16
Weld metal—1st layer..	"	0.094	16.51	9.71	1.88	...	0.72
Welding rod	420	0.25	13.04	....	0.85	0.34	...
Weld metal—1st layer..	"	0.26	11.42	....	...	...	...
Weld metal—2nd layer..	"	0.27	11.90	....	...	...	...

Table II. Chemical Composition of Copper-Alloy Deposits

	% Cu	% Si	% Al	% Sn	% Fe	% Mn	% P
High Conductivity Copper							
Welding rod	Remainder	<0.01	...	...	0.09	0.006	...
Weld metal—1st layer.	"	<0.01	...	...	2.55	0.31	...
Tin Bronze							
Welding rod	Remainder	...	...	2.46	0.096	...	0.13
Weld metal—1st layer.	"	<0.01	...	2.06	0.37	0.54	0.047
Silicon Bronze							
Welding rod (nominal)	Remainder	3.40-3.85	...	...	max. 0.25	0.65-0.95	...
Weld metal—1st layer.	90.28	1.80	...	...	4.35	2.47	...
Aluminum Bronze							
Welding rod (nominal)	Remainder	...	8.0	...	2.75	...	...
Weld metal—1st layer.	79.43	0.92	6.21	...	9.38	3.60	...

Table III. Chemical Composition of Nickel and Monel Deposits

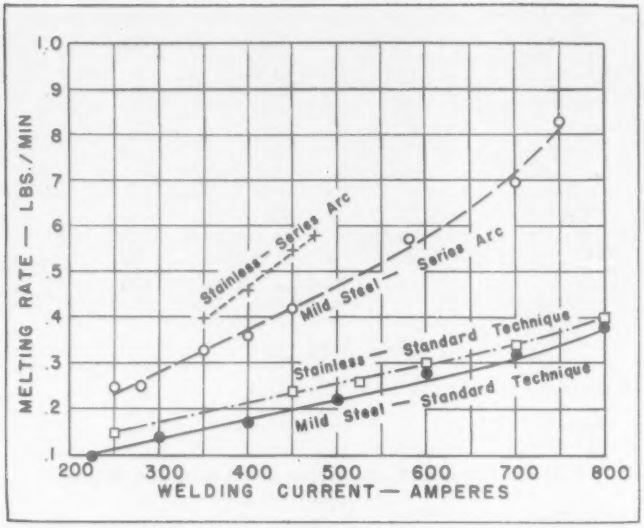
	% Fe	% Mn	% Si	% C	% Cu	% Ni
Nickel						
Welding rod	0.06	0.25	0.18	0.12	0.28	98.67
Weld metal—1st layer	9.43	1.17	0.19	0.056	....	89.10
Monel						
Welding rod	0.32	0.80	0.18	0.17	28.94	67.62
Weld metal—1st layer	11.49	3.05	0.45	0.085	25.01	59.36

Hard-Facing Applications

The same need for low dilution exists in the application of high-alloy hard-facing rods. With single-electrode welding, the loss due to dilution has been offset in some cases by the use of multiple-layer weld beads to increase the alloy content in each subsequent layer. It has been demonstrated that, when using typical welding conditions for surfacing operations, the alloying constituents continue to increase for the first four or five layers, and these values gradually level off at a point somewhat below the alloy content of the welding rod. Obviously, there is a difference in hardness between the weld metal immediately adjacent to the base plate and at a point some distance from the parent metal.

With the series-arc welding technique, the compositions of the first layer of the weld deposit and all subsequent layers closely approach that of the welding rod. As an example, look at the data presented in Table I on a typical deposit produced with type 420 rods. Rockwell C scale hardness readings taken in the first- and second-layer deposits averaged 47.8 and were exceptionally uniform throughout the sections. Another important fact is the high carbon retention in these deposits. Since carbon has a predominant influence on the hardness of the deposited metal, it is essential to retain it in the weld metal. Comparative results with conventional single-electrode, work-in-circuit techniques show a definite loss of carbon during welding operations.

Some work has been done with fabricated welding rods. These rods, consisting of a plain carbon-steel sheath filled with finely divided high-carbon ferro-alloys, generally operated satisfactorily with the series-arc technique. They were found to produce shallow penetration patterns, similar to those obtained with solid rods. With this type of rod and technique, it has now become feasible to produce many of the high-alloy metals, frequently used for high-temperature and corrosion-resistant applications, in the form of continuous coiled wire for submerged-arc welding. Complex high-alloy metals



9—MELTING-RATE curves for mild-steel and stainless electrodes. Compare series-arc curves with those for standard one-electrode technique

have been quite expensive or impossible to produce in solid coiled form for automatic welding. Moreover, dilution of the alloys with base plate materials has greatly reduced their effectiveness when applied by electric arc methods. The series-arc technique offers a new and economic method.

Non-Ferrous Cladding

Many opportunities exist in the field of non-ferrous welding and cladding where corrosion resistance, high thermal conductivity and resistance to frictional wear are of primary importance. Again, the reduction of penetration to a minimum and the control of weld metal composition are imperative to retain the desirable properties in the deposited metal. Copper, nickel and their many alloys are typical of metals useful as cladding materials on steel. Considerable development work has been done with selected alloys from these two groups.

High-conductivity copper wire was deposited as a cladding layer on mild steel (Fig. 8). It will be noted that only a thin layer of base metal has been fused in forming the bond between the weld deposit and the parent metal. For this work it was necessary to employ direct current. Welding conditions were: 425 amp, 28 volts, ¼-in. electrode, a travel speed of 12 ipm, 50 grade flux, 8 by 48 mesh, preheat to 700-750 F. Chemical analyses of the welding rod and deposited metal are listed in Table II. Based on the iron content of the weld deposit, the dilution in this case was 2.46%.

Several other types of copper-alloy deposits were produced by this technique, and typical composition data are listed in Table II. Included in the group were aluminum-, tin-, and silicon-bronzes. Welding currents ranged from 325 to 450 amp, depending upon the size of rod employed, and the welding was done at a travel speed of 12 ipm. Because of the low melting temperatures of these metals compared with plain-carbon steel, it was not possible to use the standard grades of flux. However, welding compositions have been developed for welding these copper alloys.

Build-up and Reclamation

Nickel and Monel deposits have also been laid with the series-arc technique, and compositions of these welds are shown in Table III. It was found necessary to reduce the speed of travel somewhat, when depositing nickel, to avoid porosity. The resultant weld surfaces were particularly clean after welding, and smooth overlapping of successive weld beads was obtained.

An important and unique advantage of this method of welding is the attainment of a high ratio of deposited rod metal to fused base metal as compared with conventional single-electrode techniques. This result is possible because of the configuration of the welding zone. Since only a small percentage of the heat energy is consumed in fusing the base plate, the melting rate of the welding rod for a given current is considerably higher than with standard techniques. It is possible to deposit rod metal at a rate slightly greater than twice that obtained with a single rod, with only enough base metal melted to form a complete bond across the interface.

This method of welding is economical for repairing and rebuilding worn surfaces and producing such items as integral bosses and reinforcing pads where the primary concerns are a low heat input to the base metal and a rapid deposition rate.

Five Major Advantages

Investigation of the series-arc technique of submerged-arc welding indicates that several unique and important advantages are gained by the use of this method of welding.

(1) It provides a convenient means of controlling the depth of penetration into the base metal. Depth of penetration may be reduced to a minimum.

(2) Since weld-metal dilution can be readily maintained below 10%, production of high-quality clad steel structures by submerged-arc welding may be accomplished economically at normal speeds of travel.

(3) The melting rate of the rod (weight melted per unit of time per unit of current) is approximately doubled since only a small amount of heat energy within the welding zone is consumed in melting base plate material.

(4) The application of heat to the base plate can be limited, thus making possible not only the surfacing of thin base metals but also welded joints where minimum heating of the base metal is desirable.

(5) For surfacing applications where high hardness is required, carbon retention in the deposited metal is much greater than in conventional single-electrode methods.

1940-1950

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and phenomenal user acceptance

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I should like to thank the welding engineers and the welders of America who have so whole-heartedly supported our efforts. I should also like to renew our pledge of never-ceasing research and continued production expansion in the development of rods, electrodes and fluxes, that will bring even greater advances in increased speed, safety, and savings to your welding operations.

Cordially yours,

Robert Wasserman
President

Forty-four years ago, my father began research on a method of joining metals at heats below the melting point of the base metals involved. Later on, I had the privilege of continuing this work with him to the point where we perfected a new metal-joining process utilizing an entirely *different* kind of welding rods and electrodes *that yield radically new results.*

To distinguish our new line of filler metals, we coined the phrase, "Low Temperature WELDING ALLOYS", which is registered in the U.S. Patent Office as a *Trade Mark* of this company.

When, in 1940, these vastly improved techniques were introduced to American industry, it was my privilege to establish and to guide a basic policy that was to keynote our activities for the next decade: "CONTINUOUS RESEARCH AND SERVICE"

Today, in our tenth year of uninterrupted progress, the results of that unceasing determination to overcome the failures of old fashioned, high-heat welding methods may be measured in many ways.

One gauge of effectiveness lies in the long list of EUTECTIC's developments that have become veritable "milestones" in the advancement of American welding techniques.

✓ The first nickel-bearing, copper zinc welding alloy. (U.S. Patents No. 2,279,282 and 2,279,283)

✓ The first nickel-bearing, copper zinc welding alloy containing silver. (U.S. Patent No. 2,279,284)

✓ Truly color-matching process for welding cast iron at low heat. (U.S. Patent No. 2,288,869)

✓ Low-melting, high silicon content, aluminum joining alloy for use with specially compounded flux. (U.S. Patent No. 2,481,053)

✓ Low-melting flux specially compounded for use in the welding of ferrous metals. (U.S. Patent No. 2,479,798)

✓ Covering of welding rods with special metallic film. (U.S. Patents No. 2,359,813 and 2,410,850)

✓ Fully machinable, low-amperage electrode for welding cast iron. (U.S. Patent No. 2,410,850)

✓ High-strength electrode for welding aluminum without spatter or fumes. Trademarked "EutecTrode 2101." (U.S. Patent Pending)

✓ High Quality fluxes used in conjunction with gas rods and electrodes for the welding of aluminum, aluminum alloys and magnesium. Trademarked "Eutector."

✓ Series of low-melting alloys for color-matched joining of aluminum, brass, bronze, copper, and nickel alloys.

✓ AC-DC cutting electrode that cuts, pierces, chamfers all metals without oxygen. Trademarked "CutTrode."

✓ Mass-produced 'contact-type' electrode for swifter, safer welding of steel. Trademarked "Hand-O-Matic."

✓ 'Easy-to-use' electrode for multiple-pass welding of mild steel without intermediate slag chipping. Trademarked "Steel-Tectic."

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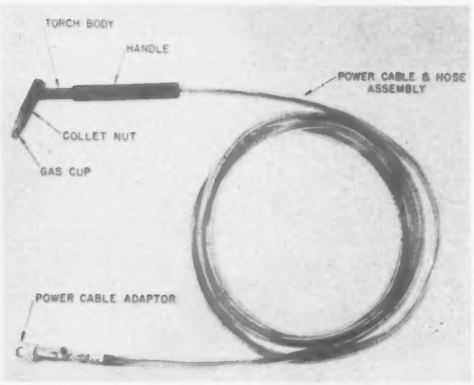
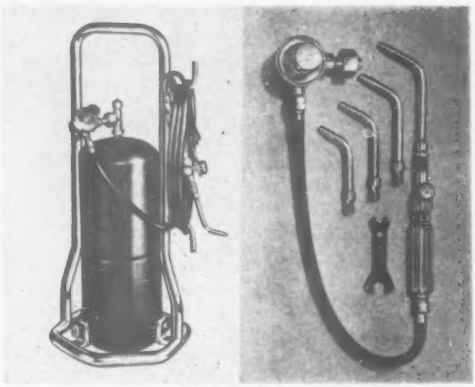
New products



AIR-COOLED inert-arc torch with reversible head weighs only 3 oz. Its top rating for continuous duty is 75 amp



PILOT LIGHT, plastic handle feature "Sod-R-Braze" torch (right). Aluminum carrying stand makes outfit portable

New Inert-Arc Torch Weighs Only 3 Ounces

MODEL HW-9 torch for inert-gas-shielded arc welding achieves its light weight by air cooling. The torch head and handle assembly weigh only three ounces. Maximum current capacity for continuous duty is 75 amp.

The torch head is set at a 120-deg downward angle from the handle for normal welding; for reaching into tight spots, the head can be changed to a 60-deg backward angle by interchanging the collet nut and torch cap.

The collet nut is part of the torch body—giving it a quarter turn frees the electrode from the holder. Collets are available for 0.020, 0.040 and 1/16 in. diameter electrodes. A single cable, 12½ ft long, carries both power and gas. A 24-ft cable is available as an accessory.

This inert-arc torch can be used with either straight-polarity direct current or with high-frequency-stabilized alternating current.

THE LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City 17.

* * *

Acetylene Compressing Plants Made by Sight Feed

CUSTOM-MADE acetylene compressing plants are now manufactured by Sight Feed Generator Co. Generator for the new plants is the recently announced Model A-Twin Continous Flow generator. Use of this generator, says Sight Feed, eliminates the need for a gas holder since it supplies enough pressure to force acetylene through both purifier and piping systems.

Without the gas holder, an expensive component is avoided and less maintenance required. In addition, there is no waste of acetylene. Compressing plant capacities varying from 240 to 3,000 cu ft per hour will be made.

THE SIGHT FEED GENERATOR CO., West Alexandria, O.

* * *

Thoriated Tungsten Electrodes For Inert-Arc Welding

COOLER operation and elimination of contamination are claimed for new thoriated tungsten electrodes for inert-gas-shielded welding. Used in d-c straight polarity welding, the "Thor-Tung" electrode is said to have unusual arc stability at both high and low currents. Since it does not become molten, the electrode may be pointed for continuous operation at very low currents.

On high currents, the hotter arc allows deeper penetration and faster weld speeds. Lowered gas consumption and less distortion are also realized.

Because there is no risk of contamination, touch starting is practical at low currents and accidental touching causes no blemishes.

AIR REDUCTION SALES CO., 60 East 42nd St., New York City 17.

* * *

Solder Flux Comes in Handy Stick

A NEW soldering flux is applied to both cold and hot metals in pencil form, doing away with bottles, cans, brushes, etc. The flux is claimed to be non-running, non-acid and to be an efficient cleaner.

LAKE CHEMICAL CO., 3052 West Carroll Ave., Chicago 12.

Built-In Pilot Light On New Air-Gas Torch

THREE new features show off the "Sod-R-Braze" air-acetylene torch: a built-in pilot light, a diaphragm valve and a lightweight plastic handle. Thumb control of the flame and the pilot light aids easy adjustment. The fire-resistant plastic handle is grooved for a firm grip and cool operation.

Six different tips, with individual mixers, come with the torch. A regulator provided with the "Sod-R-Braze" outfit permits 1 to 15 psi of acetylene flow for various tip sizes.

For use when working around refrigerating tubing, a refrigerant detector that attaches to the torch handle is available.

Also built for the "Sod-R-Braze" is the "Carryall," a carrying stand of aluminum tubing that makes the entire air-acetylene outfit portable. It holds a 40 cu ft acetylene cylinder, torch, hose, wrench and torch lighter.

NATIONAL CYLINDER GAS CO., 840 North Michigan Ave., Chicago 11.

* * *

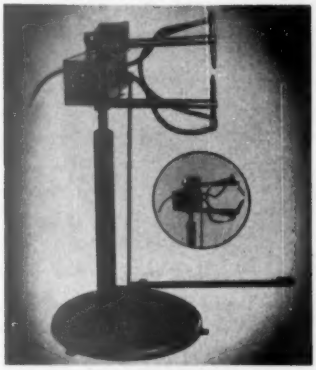
Aluminum Solder Has 500 F Melting Point

NEW "Alumaweld" solder joins aluminum, aluminum-bronze, cast iron, steel, phosphor-bronze, etc. Its melting point is about 500 F. The deposited metal is said to have a fine crystalline structure because it is cold rolled during manufacture to attain homogeneity and fineness of grain.

Special "Alumaweld" solders and fluxes are also available for unusual soldering and coating jobs.

JOHNSON MFG. CO., Mount Vernon, Iowa.

for welding



Rocker-Arm Welder Features Simple Build

NEW pedestal rocker-arm welder for general use has reversible arms for vertical and offset electrode holders. Its simple construction is claimed to pay off in low maintenance costs. Welder shown above has a 5-kva rating at 50% duty cycle, using 220-volt, 60-cycle current. It will weld two thicknesses of material from 28 gage to 20 gage. Throat depth may be varied from 3 to 15 in. The welder is available with both air-cooled and water-cooled holders as well as electronic timers.

UNIVERSAL WELDER CORP., 760 Carnegie Ave., Cleveland 15.

* * *

New Scaling Hammer Said to Save Time

THE new Churchward scaling hammer has a multi-point hammer surface said to speed descaling over a large surface with less effort, hollow ground points to remove weld spatter and special slagging picks to get the slag out of small weld pockets and corners. Savings of 30% in scaling time are said to be effected because of these improvements and the good balance of the tool.

JACK CHURCHWARD WELDING ACCESSORIES, North Haven, Conn.

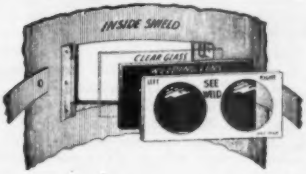
Wider Cuts Made by New Powder-Scarfing Torch

THE new Oxweld FSP-2 torch makes a wider cut, enabling stainless-steel slabs to be powder-scarfed with greater speed and economy. It is possible to make passes as wide as 2 to 2½ in. as contrasted to 1 to 1⅜ in. with older models.

Another advantage claimed is a cutting speed twice that of other models. The greater speed cuts down the use of powder per square foot: for a 1½-ton slab, powder consumption is cut from 75 to 25 lb. Material loss is also said to be less.

THE LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City 17.

* * *



Magnifying Lenses for Welding Helmets

WELDORS who have to wear spectacles can see just as well in a welding helmet with the new "See-Weld" lenses. These are ground and polished magnifying lenses. The lens (which provides magnification only) is inserted in a rectangular sheet of plastic, which is mounted in the helmet as shown in the picture above.

Such lenses are said to enable the weldor wearing bifocals to hold his head in a normal position while welding. Otherwise, he would have to tip his head so far back that welding is difficult.

"See-Welds" come in six focal or magnifying powers. Special focal powers can be made to order.

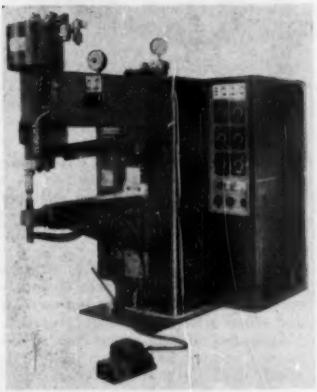
THE BUELL W. NUTT CO., 2225 South Hoover St., Los Angeles.

* * *

New Grinding Bond Lasts Longer

A 5 to 10% boost in weld grinding output is claimed for vitrified grinding wheels bonded with "79E" bond. The new bond is said to afford a smoother, faster cutting action at speeds up to 6,000 surface feet per minute. It is recommended for the cutting of stainless steel welds and forging dies.

CHICAGO WHEEL & MFG. CO., 1101 West Monroe St., Chicago 7.



New Spot Welder for Aircraft Aluminum

NEW three-phase spot welder is designed for welding heavier thicknesses of aluminum including primary structural members of aircraft. It can be quickly adjusted by control settings to different metals and thicknesses.

Called the PMCO2ST "Modu-Wave" welder, this press-type machine operates at about 85% power factor. It is rated at 100 kva at 50% duty cycle. Power source should be 220 or 440 volt, 3-phase, 60-cycle current. Standard throat depth is 36 in., though other depths are available.

Welding range on low-carbon steel is from 0.022 to 0.156 in. (two thicknesses); on aluminum and magnesium, the range is from 0.025 to 0.081 in. For welding of heavy gauges of ferrous alloys, pulsation controls are provided. There is also an adjustable pressure regulator for controlling time of forging pressure.

SCIAKY BROS., INC., 4915 West 67th St., Chicago 38.

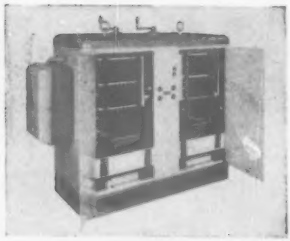
* * *

Aluminum Solder Flux Renewed with Water

BRAZALOY No. 39, an aluminum flux, uses common water as a solvent. When it dries out, it can be reactivated by simply pouring in more water.

This flux can be used with aluminum solder rods of any commercially available brand, either with an open flame or (under certain conditions) with a soldering iron. It is said to tin so thoroughly that it enables aluminum to be soldered to copper, steel or bronze. The flux is available in drums, cans and jars.

ALL-STATE WELDING ALLOYS CO., INC., 273 Ferris, White Plains, N. Y.



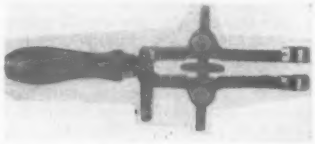
Rectifier D-C Welder Has Two Welding Circuits

Two welding circuits—300 to 600 amp, 400 to 800 amp—are provided in a common enclosure in a new selenium-rectifier d-c welder. These circuits can be used independently or in parallel to obtain twice the output.

Parallel operation is easily achieved by placing a bridle across the secondary output terminals. A clutch-and-sprocket and chain arrangement makes possible independent or single operation of the current control handles on each individual welder. A primary contactor is supplied to facilitate use of these welders on automatic and stud welding applications.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30.

* * *

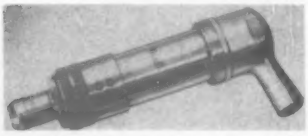


R-W Tip Dresser Maintains Original Contour

Redesigned Model 3 tip dresser for resistance welding electrodes is claimed to maintain original standard, truncated cone, domed or Morse No. 1 and 2 radius contour. The cutters are replaceable tool steel. Body is forged brass and is adjustable for machine openings from 1 to 4 in. Cutter pressure is exerted by turning the large knurled thumb screw between arms. Tips can be dressed with current on. There is no need for machine pressure.

S-M-S Corp., 1165 Harper Ave., Detroit 11.

* * *



No Recoil Claimed for Chipping Hammer

Air-powered chipping hammer operates only when pressed into the work. It stops when it's withdrawn, practically eliminating recoil. The hammer also features force-of-blow control, adjustable from a light tap to heavy blows. It operates on line pressures varying from 30 to 100 psi. Overall length is 9 in.; piston diameter, 1 in.

Burgess Thomas Co., P. O. Box 287, Bloomfield, N. J.

* * *

Seven Improvements on New Trindl Welder

New engineering developments in the remodeled Trindl Model 125A arc welder include: improved cooling, sloping control panel for easier access, solderless connectors, simplified terminal control, greater ease of arc striking, spun-glass insulated transformer and fully insulated terminals.

This welder has 16 heat stages, ranging from 20 to 125 amp. Like other Trindl welders, it is furnished equipped with weldor's helmet, electrode holder, ground clamp, welding cables, a supply of 1/16 and 5/32 in. electrodes and a set of operating instructions.

Trindl Products, Ltd., 17 East 23rd St., Chicago 16.

* * *

200-Amp A-C Welder Makes Compact Package

Latest development in the Wilson line of a-c transformer welders is the Model MCX with a rating of 200 amp. Its compact size, 12 by 17 by 23 in., makes it applicable to many shops and plants doing everything from light sheet metal to heavy industrial work. Rating is for 50% duty cycle.

Three current ranges are selected by tapered plug connectors. Within each range, hand cranks provide adjustment between 30 and 250 amp. Silicone insulation is claimed to be temperature-resistant and water repellent. Another feature is an automatic hot start control with a gas-filled, time-delay relay magnetic switch that has no open contact.

Air Reduction Sales Co., 60 East 42nd St., New York City 17.

* * *

Hard Chrome Plate Ups Tool Life 10 Times

Cutting tools and wear parts last from three to ten times longer when chrome-plated with the Model A-20 "Chromaster" and "Chromasol" solution, it is claimed. "Chromasol" is a new, non-critical plating solution that delivers a hard chrome plate at a constant rate of deposition of 0.002 in. per hour.

The "Chromaster" provides complete plating facilities for plating surfaces up to 10 sq in. It includes a plating bath tank, rheostat, timer, ammeter, dry-disc selenium rectifier and reversing switch for stripping action.

Average time for plating cutting tools and similar size parts is 1½ minutes. Thickness of deposition is said to be controllable by proper timing to less than 0.0001 in.

Industrial Chrome Division, Ward Leonard Electric Co., Mt. Vernon, N. Y.

* * *

Industrial Wheels Have Three Hub Styles

New pneumatic and zero-pressure rubber-tired industrial wheels come in three hub styles: low speed, fork mounting and spindle mounting. They have a lug base, drop center and demountable rim. Diameters range from 6 to 20 in.

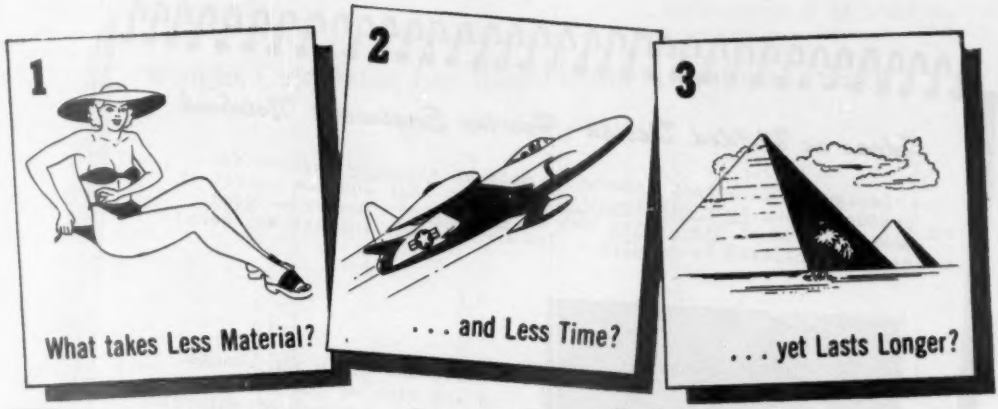
Dico Corp., 200 S. W. 16th St., Des Moines 5, Ia.

NEW PRODUCT BRIEFS

Industrial fluid cooler accurately controls temperatures of coolants such as water in welders, grinding oils in machines or plating solutions. "Frostrode" coolers use an air-cooled refrigeration cycle with minimum pressure drop. Progressive Welder Sales Co., 3070 East Outer Drive, Detroit 34.

* * *

Washable, marking crayon writes on metal, wood and glass. Marks wipe off with a damp cloth. Called "Crayoffs" they come in eight colors. Celco Corp., 1631 Tenth St., Santa Monica, Calif.



Three questions about hard facing with but one answer–

COLMONOY SPRAYWELD PROCESS*

*A process of *welding* sprayed metal

1. *Less Material* is used with the Sprayweld process than with hand welding because the thickness of the overlay is easily controlled to within .010".

2. *Less Time* is required to spray and fuse than to laboriously apply the overlay with a rod. Most time is saved in finishing the work, the Sprayweld application being much closer to finish dimensions than hand welding.

3. A Sprayweld surface *Lasts Longer* because it is dense and smooth, with no pinholes or porosity. Colmonoy alloys, used in Spraywelding, are highly abrasion and corrosion resistant, and give up to 25 times longer life, than original equipment.

SPRAYWELDER IN ACTION

Here the spraywelding of an 18.8 stainless steel autoclave shaft is in progress. Colmonoy No. 6, the alloy being sprayed, has great resistance against the wear and corrosion caused by gases under pressure (encountered in the synthesis of ammonia). This shaft will last 12 times longer than would an unfaced one.

ORDER FROM YOUR LOCAL JOBBER

WALL COLMONOY

CORPORATION

HARD FACING ALLOYS

19345 JOHN R STREET DETROIT 3, MICHIGAN

Colmonoy is a complete line of hard facing alloys. They have various properties and come in many forms: rod, wire, powder, paste and castings. Powdered Colmonoy 4, 5, and 6, all nickel base alloys, can be used in the Colmonoy Spraywelder.

The Colmonoy Spraywelder is the powder metallizing gun, shown below. It provides a simple, low-priced method of applying hard facing alloys to withstand corrosion and abrasion.

This process we call Spraywelding. You *spray* the Colmonoy alloy on, then *weld* it by bringing the overlay to a fusing temperature. Thus Colmonoy Spraywelding combines the advantages of two familiar processes: the *smooth application* of metallizing, with the true *molecular bonding* of welding.

Many *worn* parts, commonly discarded, may now be hard faced the Sprayweld way.

Many *new* parts, commonly made of expensive, hardened alloy steel, may now be made of mild steel and Spraywelded with Colmonoy.

The process is essentially three steps:

- Preparing the surface by grit blasting or by rough threading.
- Spraying the surface with the Colmonoy Spraywelder or your own metallizing equipment (using Colmonoy Spray Weld wire).
- The fusion of the overlay to the base metal by using an oxy-acetylene torch, or controlled atmosphere furnace.

WALL COLMONOY CORPORATION

19345 John R Street • Detroit 3 • Michigan

Please send me information about Colmonoy hard facing alloys.

Name _____ Title _____

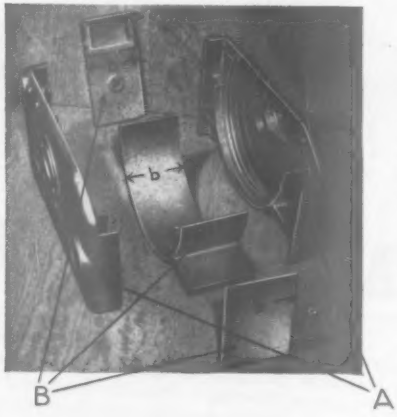
Firm _____

Street _____

City _____ State _____

Ideas on Welded Design—For the Engineer's Notebook

Design of a coolant separator, made of aluminum, called for production in four different sizes. But what was the secret of making these at high rates and at low costs? Answer — good design, followed by welding. And here is how the job was done:



Only the width was changed as the size of the separator increased, instead of enlarging all dimensions. Identical end pieces, marked "A" were used for all models. Only the center pieces, marked "B," were cast in different widths, with the one dimension, "b," changed.

Next, the cast sections were assembled by HELIARC welding — ideal for aluminum. Here, the HELIARC HW-4 torch is doing the job.

Usual problems of producing complicated castings were eliminated by the design of simple castings and the joining of these parts by HELIARC welding. Rejections were minimized. Result — four different models at high production rate and at low cost.

For additional information about HELIARC welding and other LINDE methods, and for help in solving your production problems, please call our nearest office.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

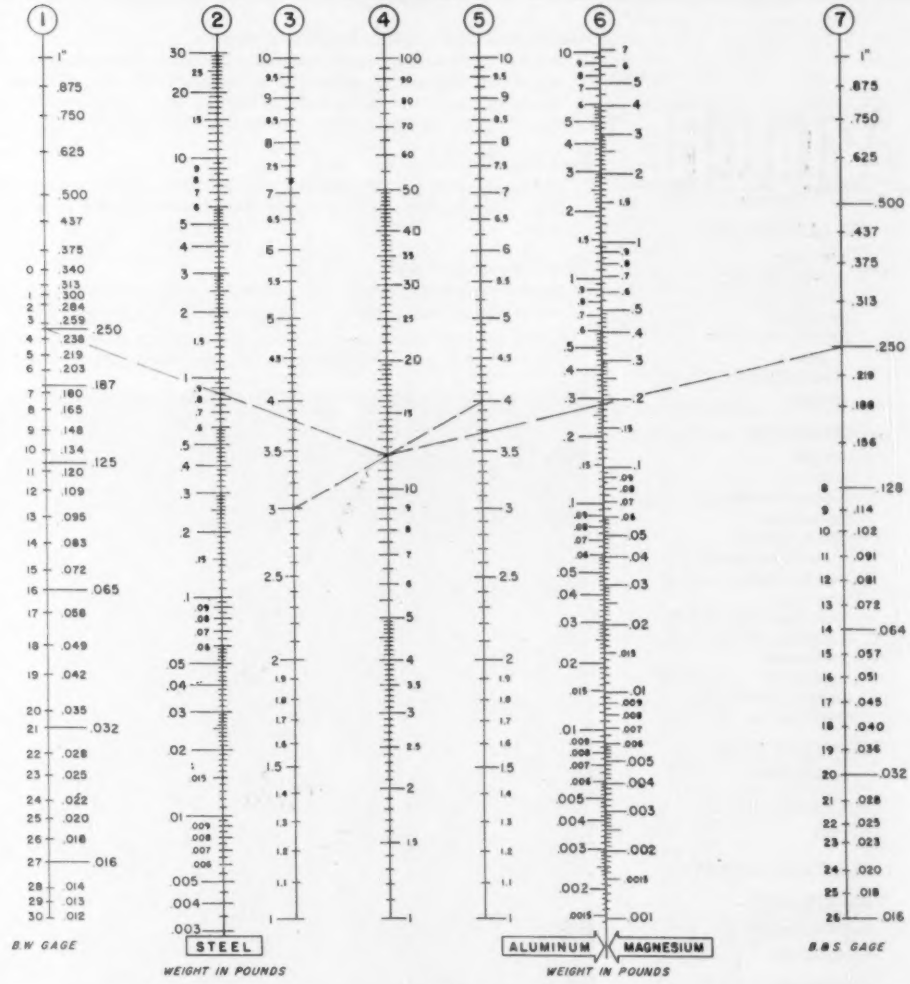
30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

The term "Heliarc" is a registered trade-mark of The Linde Air Products Company

Weight Calculator for Magnesium, Aluminum, Steel

BY HARRY M. LUI



THE ABOVE NOMOGRAM PROVIDES A SIMPLE MEANS FOR CALCULATING AND COMPARING WEIGHTS OF MAGNESIUM, ALUMINUM, AND STEEL PARTS AND, INCIDENTALLY, FOR GENERAL MULTIPLICATION AND DIVISION.

1. LOCATE LENGTH AND WIDTH OF PART ON LINES ③ & ⑤ RESPECTIVELY. A STRAIGHT LINE CONNECTING THESE POINTS INTERSECTS LINE ④ INDICATING AREA OF PART IN in^2.

2. FOR MAGNESIUM AND ALUMINUM LOCATE THICKNESS OF PART ON LINE ⑦. CONNECT THIS POINT BY STRAIGHT LINE WITH THE VALUE FOUND ON LINE ④ AND READ THE WEIGHT IN POUNDS ON LINE ⑥.

FOR STEEL USE LINE ① FOR THICKNESS AND READ THE WEIGHT VALUE ON LINE ②.

3. FOR PARTS WHOSE WIDTH OR LENGTH EXCEEDS 10" (OR THICKNESS EXCEEDS 1") USE THE NOMOGRAM WITHOUT REGARD TO DECIMAL POINT UNTIL THE WEIGHT IS OBTAINED. THEN MOVE THE DECIMAL POINT OF YOUR RESULT AS REQUIRED.

IF ONE, TWO, OR ALL THREE FACTORS ARE MULTIPLIED BY 10, MULTIPLY THE ANSWER BY 10, 100, OR 1000 RESPECTIVELY BY MOVING THE DECIMAL POINT ONE, TWO, OR THREE PLACES TO THE RIGHT. FOR EXAMPLE:

A MAG. PART 3"x 4"x .25" WEIGHS .19 POUNDS,
A PART 3"x 40"x .25" WEIGHS 1.9 POUNDS,
A PART 30"x 40"x .25" WEIGHS 19 POUNDS,
A PART 30"x 40"x 2.5" WEIGHS 190 POUNDS.

4. FOR GENERAL MULTIPLICATION AND DIVISION USE LINES ③④⑤.

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3 IMPORTANT REASONS FOR STANDARDIZING ON VICTOR WELDING AND CUTTING UNITS

VICTOR
Welding and Cutting Equipment
Since 1910

REGULATORS for
acetylene
carbon dioxide
compressed air
hydrogen
liquid petroleum gases
medical gases
oxygen

TORCHES for
air gas
brazing
bunsen burner
descaling
flame cutting
flame hardening
hand cutting
heating
lead burning
machine cutting
preheating
soldering
surface hardening
welding

WELDING ROD
for all uses

HARD-FACING
alloys

BLASTING nozzles

PNEUMATIC
regulator-filter-lubricator

CYLINDER MANIFOLDS for
all types of cylinder gases

CYLINDER TRUCKS

WRITE today for descriptive literature and name of nearest distributor.

Unlimited Opportunity for Expansion

All VICTOR welding and cutting units handle a wide variety of welding and cutting jobs. To expand them for new needs or special work—descaling, flame cutting, multi-flame heating, priming, etc.—just select the VICTOR tip, nozzle or attachment your job requires.

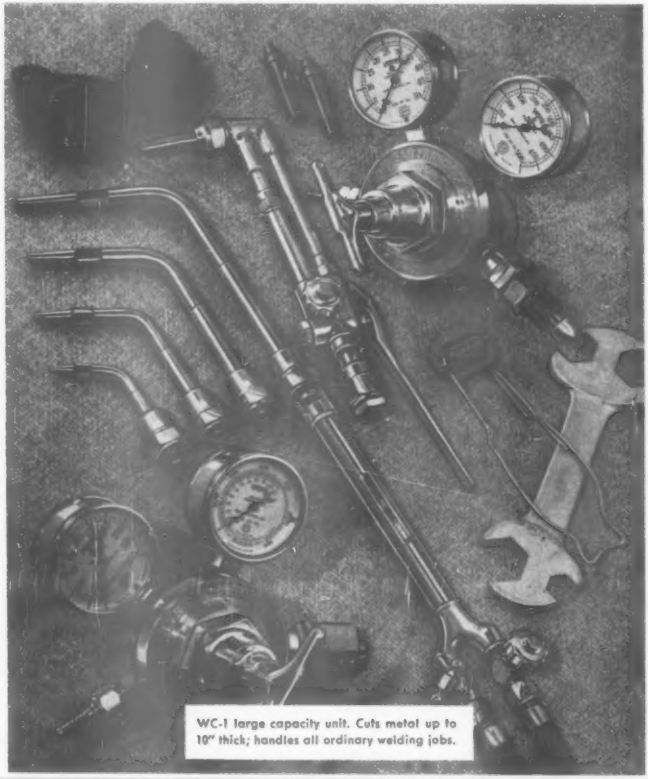
Low First Cost

When you use VICTOR you keep your investment in line with production . . . you buy only parts or attachments as needed . . . not a whole new outfit.

Low Operating Cost

Finally, because you can use the exact tip or nozzle needed for each job, you get better flame control, use less gas, and do better, faster work.

See for yourself why so many welders say it costs less to own and operate VICTOR. Ask your VICTOR dealer for a free demonstration TODAY.



WC-1 large capacity unit. Cuts metal up to 10" thick; handles all ordinary welding jobs.

VICTOR EQUIPMENT COMPANY

3821 Santa Fe Ave.
LOS ANGELES 58

844 Folsom Street
SAN FRANCISCO 7

1312 W. Lake St.
CHICAGO 7

For Your Technical Library—

Free Catalogs • Booklets • Bulletins

A Welding Engineer Reader Service

1 U. S. BUSINESS HISTORY—United States Steel Supply Co., Dept. M.D., Chicago 4. Four-Color chart measuring 9 by 45 in. shows business booms and depressions since 1796. New features are census significance, employment levels, wage rates, retail sales and per capita income. Special indices show effect of war production on our economy.

2 HARD-FACING RODS — Armite Laboratories, Los Angeles 1. 6-page, two-color pocket-size folder gives hardness ratings, diameters, applications, and advantages of eight hard-facing alloys.

3 COMPRESSING ACETYLENE—The Sight Feed Generator Co., West Alexandria, O. Bulletin tells about complete compressing plants for acetylene using the Sight Feed Model A-Twin generator as gas source.

4 ALUMINUM SOLDER — Johnson Mfg. Co., Inc., Mt. Vernon, Ia. Bulletin tells how "Alumaweld" solder is used to join aluminum, aluminum-bronze, cast iron, steel and phosphor-bronze. Illustrations and text discuss metal characteristics and application hints. See page 44.

5 A-C WELDER—Trindl Products, Ltd., Chicago 16. 4-page two-colored bulletin describes a new a-c transformer welder with seven engineering improvements over the former model. Equipment coming with welder is listed. See page 46.

6 LENS COATING—Wallace Optical Co., Inc., Detroit 26. Single-sheet bulletin explains the advantages of using "Tuf-Cote" lens coating on welding goggles and plates, and tells how it is applied and how it works.

7 AIR CYLINDERS—Miller Motor Co., Chicago 18. 8-page, two-color bulletin A-105 gives mounting data, construction features and engineering specifications on Miller Model A series of non-rotating air cylinders.

8 PREHEAT TORCH—Hauck Mfg. Co., Brooklyn 18. Single-sheet two-color bulletin describes the Hauck line of portable gas torches for preheating weldments and other uses.

9 WELDING DESIGN — Eutectic Welding Alloys Corp., New York City 13. 40-page welding design manual covers basic and advanced welding techniques in low temperature welding.

10 TRACK TURNING ROLL—Aronson Machine Co., Arcade, N.Y. 4-page, two-color bulletin TT-1 tells about the "Trac-Tred" turning roll for welding light-gage tanks. It lists and shows advantages of the rubber track for this work and other uses.

11 FACE MASK—Acme Protection Equipment Co., Chicago 12. 4-page bulletin shows applications of new Acme No. 6 face mask for use under welding helmets or other types of equipments.

THE WELDING ENGINEER will request manufacturers to send readers the literature in which they are interested. Two post cards are printed here, each containing space for four items.

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12 SILVER BRAZING — Goldsmith Bros. Smelting and Refining Co., Chicago 36. 4-page data sheet No. 603 outlines all methods of silver brazing, including: oxyacetylene, induction, air-gas, resistance, salt bath, oxyhydrogen, furnace brazing, etc.

13 MAGNIFYING WELDING LENS—The Buell W. Nutt Co., Los Angeles. 4-page booklet explains a new welding lens with magnifying powers for weldors with eye defects. Illustration shows construction of lens and text tells powers available. See page 45.

14 AIRCRAFT SPOT WELDER—Sciaky Bros., Chicago 38. 4-page, two-color bulletin gives specifications on the three-phase PMCO2ST welder for heavy aluminum sections. It tells welding ranges, power ratings, controls available, etc. See page 45.

15 WELDING LENSES—Modern Glass Processing Corp., Brooklyn 27. 4-page, two-color, pocket-size folder describes the "Rayflex" filter plates for welding. It tells visibility features, filter characteristics and lists the various sizes it comes in.

16 INERT-GAS WELDING—Metal & Thermit Corp., New York City 17. 8-page illustrated bulletin tells about M&T equipment for inert-gas welding. Operating hints and applications are also supplied.

17 ELECTRODE GUIDE — Harnischfeger Corp., Welding Div., Milwaukee 14. 56-page bulletin R7-8 provides a pocket-size reference to all P&H electrodes covering applications, descriptions, sizes. Page tabs aid rapid selection.

18 WELDING TORCHES—Air Reduction Sales Co., New York City 17. 36-page illustrated catalog contains detailed information on the Airco line of welding and cutting torches, complete outfits, tips and accessories. Charts tell correlation of tip, mixer, extension and torch. Cutaway views show working parts.

19 METALLIZING AGAINST HEAT —Metallizing Engineering Co., Inc., Long Island City 1, N. Y. 4-page bulletin 45A describes a process for protecting steel retort bottles, foundry crucibles and rotary kilns against heat oxidation.

20 INERT-ARC WELDING — The Linde Air Products Co., New York City 17. 12-page reprint from the *Welding Journal*, "Heliarc Welding in the Automotive Industry," summarizes the basic advantages of the inert-arc process for making fenders, guards, etc.

21 WELDED DESIGN—The Lincoln Electric Co., Cleveland 1. 4-page bulletin 805 pictures and discusses a case history on the advantages of welded design in heavy materials handling machinery. Problems, solutions and results are summarized.

22 ZINC WELD COATING—Industrial Metal Protectives, Inc., Dayton 8, O. 8-page illustration bulletin 100 describes "Zincilate" anti-corrosion coating for welded metals. Bulletin discusses cleaning needs, acid resistances, applications and methods of using.

23 SOLDER - FLUX — Lake Chemical Co., Chicago 12. 4-page, pocket-size bulletin on a new flux that is applied to the metal in pencil form.

24 LATHE CENTER TIPS—Diamonds and Tools, Inc., Detroit 3, Single-sheet, two-color bulletin describes center tips for lathes and grinder cast from "Colmonoy No. 6," a hard-facing metal. Text tells advantages; supplementary data sheet CT2 shows how to apply the new tips.

25 ABRASIVE DISCS—The Metal Removal Co., Chicago 22. Single-sheet bulletin describes "Pres-On" flexible abrasive discs and disc holders of resin bonded abrasive cloth. Grit sizes, disc diameters and other specifications complete the information.

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THE WELDING ENGINEER, JAN., 1951

America's Road to Victory

. . . Let's Increase Production

This is the time to speak out—now—at the beginning.

Our industrial program for re-armament is getting off on the wrong foot.

The talking and writing about it emphasize the wrong things.

Its headline words are "cuts" and "controls."

Those words make bad propaganda for the cold war.

"Cuts" and "controls" are no words to challenge the imagination and energy of our own people. They won't impress the masters of the Kremlin. And they can only make it appear to the rest of the world that America thinks it can defend the free way of life by abandoning it.

America stands as the world's champion against aggression because America has become the most powerful free nation in the world.

How did we get that way?

Not by putting ceilings on wages; not by rationing or clamping iron-clad government controls all over business and industry.

To be sure, some temporary controls are necessary to channel very scarce materials speedily to use for defense. So, too, are special taxes and credit restrictions needed to combat inflation. But they will be fatal if they blind us to this fact:

We became the strongest nation in the world by out-producing every other nation.

Production—The Final Answer

Next year our government is planning at least a $40 billion military program. Instead of planning only on controls to divert $40 billion of production from the making of civilian goods to the making of military supplies, we should be figuring out also ways to push up total production.

Of course, our industrial plant is running at close to "capacity" now. And our labor force has reached almost full employment. There isn't much slack to be taken up.

Can even the United States add a $40 billion miracle of production on top of what it is already doing?

Our answer is "Yes"—and within two years. It can be done by adding about $6 billion each year to our program of capital investment which now runs about $22 billion a year.

Part of this added production will come from expanding our industries. The steel companies, for example, already have plans to increase their capacity almost ten per cent in the next two years.

But by far the largest part of that $40 billion of added production must come from higher productivity—raising industry's efficiency.

continued on next page

To meet our goals we need to raise our productivity five per cent a year.

Can it be done?

The answer is an emphatic "Yes."

Raise Industry's Productivity

McGraw-Hill's studies of industry's equipment show that there are countless opportunities for improving efficiency. Our manufacturing industries alone need at least $35 billion of new equipment to raise their facilities to first class technical standards.

Here are some of the broad possibilities reported by the trained editors of McGraw-Hill's business magazines:

In many manufacturing plants as much as 40 per cent of workers' time goes into moving materials and parts—shifting things about within the plant between processes and to and from shipping platforms.

FACTORY estimates that improved materials handling equipment and methods might well cut handling costs twenty-five per cent and save annually over 650,000 man-years of unnecessary labor.

Modern machine tools designed since World War II are 40 per cent more productive, on the average, than is old equipment. But AMERICAN MACHINIST surveys show that 95 per cent of industry's machine tools are of designs at least ten years old. Replacing them could raise productivity of the metalworking industries at least ten per cent—enough to absorb a major share of the metalworking industries' part of the defense program as now planned.

In coal mining, latest equipment and methods can raise productivity sharply. The editors of COAL AGE estimate that production of bituminous coal could be raised from seven tons per man-shift to ten within three to five years.

Many new textile production techniques are 50 per cent to 75 per cent more efficient than those in use now. If plants could be fully modernized, and full use made of latest management methods, TEXTILE WORLD estimates that output-per-manhour would rise 20 per cent. *A FOOD INDUSTRIES study indicates that modern equipment plus the best management techniques could raise productivity in food processing at least 20 per cent.*

These are just some of the opportunities that industry can seize and by which the nation can profit.

A Nation-Wide Effort

Of course, industry itself can't do the whole job. Labor, government and all the rest of us must cooperate.

Government's part is to see that its emergency controls are so applied that they will increase productivity and thus make possible an early lifting of such controls.

Labor's part is to help in the development of labor-saving methods and machinery and to welcome their adoption as the only sure way of continuing to advance the American standard of living while maintaining the American free way of life.

For all of us the job is to work constantly for an expanding, ever-stronger America with constantly growing productivity; not a pinched and shackled America cooped up under wage and price ceilings and tied to a ration card.

Challenge to Industry

Here is a sharp challenge to industry to study the best work-methods that are being reported—to use every minute and every dollar it can to replace obsolete equipment.

Here is a sharp challenge to government to do everything within its power to make its control policies and its fiscal policies strengthen the incentives to industrial modernization—to demand sacrifice for a purpose and not for effect.

The job to which such opportunities point will take time—though nothing holds back adoption of some of the simpler improvements in work-methods reported in business magazines all the time.

But increasing production is our one best hope that we may be spared the full array of price, wage and production controls now and be freed eventually from all controls.

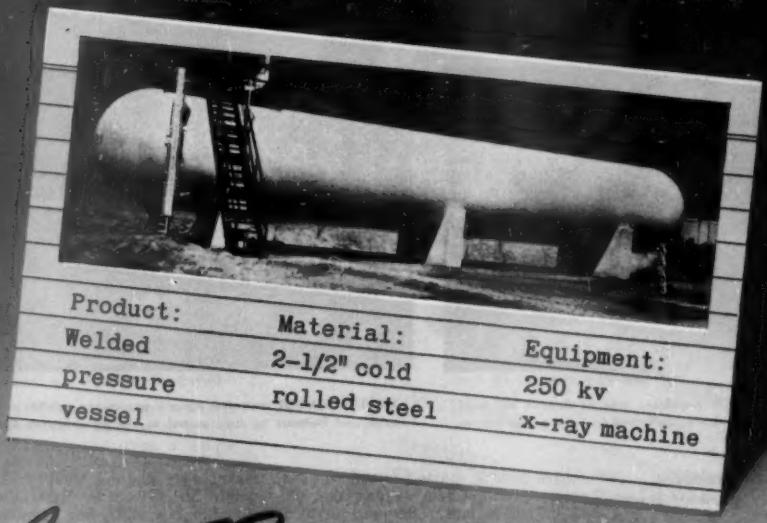
General Omar Bradley has said that the protection of our national independence calls for "long-range commitments that we are willing to carry out."

A long-range commitment to fight this battle for peace with America's most powerful weapon—industrial productivity—is the surest guarantee of victory for the free world.

Let's make that commitment—now—at the beginning.

McGraw-Hill Publishing Co., Inc.

WHAT'S THE RIGHT X-RAY FILM?



Product:	Material:	Equipment:
Welded pressure vessel	2-1/2" cold rolled steel	250 kv x-ray machine

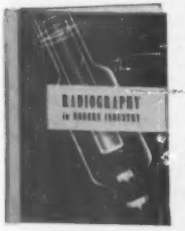
ANSWER:

KODAK INDUSTRIAL X-RAY FILM, TYPE F

To examine this pressure vessel, the radiographer was faced with a thick section of dense material, and with x-ray equipment low in power for the size of the job.

This called for Kodak Industrial X-ray Film, Type F. Because this film, exposed with Kodak Industrial X-ray Intensifying Screens, provides high contrast radiographs produced in the shortest possible exposure times.

Type F, exposed direct or with lead-foil screens, gives good results where wide exposure latitude is required, such as when a wide range of section thicknesses is to be recorded in a single radiograph.



RADIOGRAPHY IN MODERN INDUSTRY

A wealth of invaluable data on radiographic principles, practice, and technics. Profusely illustrated with photographs, colorful drawings, diagrams, and charts. Get your copy from your local x-ray dealer—price, $3.

A TYPE OF FILM FOR EVERY PROBLEM

To provide the recording medium best suited to any combination of radiographic factors, Kodak produces four types of industrial x-ray film. These provide the means to check welds efficiently and thus extend the use of the welding process.

Type A—has high contrast with time-saving speed for study of light alloys at low voltage and for examining heavy parts at 1000kv. Used direct or with lead-foil screens.

Type M—provides maximum radiographic sensitivity, under direct exposure or with lead-foil screens. It has extra-fine grain and, though speed is less than in Type A, it is adequate for light alloys at average kilovoltage and for much million-volt work.

Type F—provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

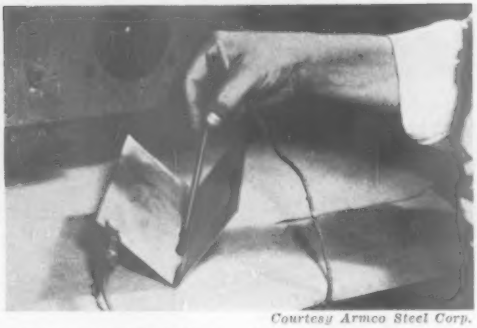
Type K—has medium contrast with high speed. Designed for gamma ray and x-ray work where highest possible speed is needed at available kilovoltage without use of calcium tungstate screens.

EASTMAN KODAK COMPANY
X-ray Division • Rochester 4, N. Y.

Radiography...
another important function of photography

Kodak
TRADE-MARK

on the job



Courtesy Armco Steel Corp.

CLEANING DISCOLORED stainless: acid is poured on weld area; work and copper rod are connected to a d-c power source

Courtesy The Linde Air Products Co.

CUTTING TORCH mounted upon a gantry rig quickly reduces skulls and buttons to sizes suited to the open-hearth furnace

New Way to Clean Stainless

(See picture at left)

RESEARCH DIVISION of Armco Steel Corp., Middletown, O., has developed a simple method of removing weld discoloration from stainless. It works particularly well when the discoloration is in hard-to-get-at interior corners.

A copper rod, some rubber tubing, electrical connections, a d-c power source and a small amount of 50% phosphoric acid solution are all the equipment needed. The copper rod, which should be about ¼ in. in diameter, is bent to a convenient shape and tipped with short pieces of tubing to enable it to be handled and to prevent it from touching the stainless steel. The copper rod must not touch the stainless; if it does, a short circuit occurs.

The acid solution is poured over the weld area; it is important to use just enough acid to contact the copper rod and wet the discolored weld area. Other acids can be used besides phosphoric, but these will etch the surface more. The acid concentration controls the appearance of the cleaned surface —higher concentration gives a brighter finish.

The copper rod is connected to the negative terminal of the d-c power source; the stainless part to the positive terminal. The copper rod is then passed along the joint to be cleaned. The rod can be moved at a rate of about two feet per minute, removing the discoloration rapidly.

The cleaning action depends on the electrical current passing through the acid solution. Since high current densities give better cleaning, the acid solution should not be deeper than recommended nor cover too wide an area. Better results are secured by cleaning small areas, using more than one pass of the rod if necessary.

The power source should provide about 6 to 9 volts direct current, and 5 to 6 amperes are required for each square inch of rod in contact with the acid. As an example, suppose that the ¼-in. rod is half submerged in acid and that the cleaning section is 2 in. long. The surface area of the rod in actual contact with the acid is approximately 0.83 sq in., requiring a current of 4 to 5 amp.

For small jobs, a six-volt storage battery is satisfactory, but a 12-volt, 50-amp rectifier is desirable for higher production or on larger work. A low-capacity d-c welder might be used as a power source for the cleaning of large welded structures; however, it might be necessary to use resistors in the circuit to reduce the voltage.

Instead of a copper rod, a flat copper strip is employed where the weld discoloration covers a large area. The strip is wrapped with acid-dampened asbestos or glass cloth and passed over the area to be cleaned. The strip method requires higher currents—5 to 6 amp per square inch of strip—because of the larger contact area; current density, however, is the same.

* * *

Testing for Brazeability

PRESENCE of very minute quantities of impurities, detection of which would require elaborate testing equipment, may seriously affect the drawing, bending or joining of metal parts. To make sure that a particular lot of cupro-nickel alloy would produce no trouble during brazing, a procedure for testing it during manufacture was worked out by The Riverside Metal Co., Riverside, N. J.

Large amounts of the cupro-nickel alloy were used in the manufacture of heat exchangers. The manufacturer had to shut down his production line periodically because of defective brazing; *i.e.*, the exchangers were being delivered from the furnace with the brazing metal and parent metal unjoined. Much investigation revealed that only particular heats of the cupro-nickel were causing trouble. At this point, The Riverside Metal Co. was called in as a consultant.

The problem was to discover the reasons for the unreasonable behavior of the alloy during brazing. Usual physical and chemical tests disclosed no clues. Riverside then sought for a method of testing each heat to determine its brazeability.

The following test procedure was set up:

During the casting of each heat, a test coupon is taken for the determining of brazeability. This coupon is in addition to the coupon of each heat taken for purposes of chemical analysis, long a standard procedure at the Riverside plant. The brazing test coupon is taken immediately to the laboratory rolling mill and reduced to thinner gage. The test pieces are then put into a combustion tube furnace and held at 2,050 F for 15 minutes in order to duplicate the time, temperature and atmosphere conditions of actual brazing.

When a sample comes out of the furnace, its surface is examined visually. The heat has good brazeability characteristics if the surface is bright. If the surface is dull, the heat is rejected for heat exchanger stock and diverted to some other application that requires no brazing during fabrication.

* * *

Gantry Rig for Scrapping

(See picture at right)

SLAG-ENCRUSTED skulls, spills and ladle buttons from the open-hearth presented a formidable problem in scrapping to one steel mill. Oxygen lancing was slow and laborious on these thick masses of steel. It was finally decided to install a heavy-duty powder-cutting torch mounted upon a machine carriage.

A feature of this installation is that the cutting torch, machine carriage and track are all mounted upon a gantry rig, which can be moved by electric

motors to any position over the cutting bed.

The torch itself is mounted on an arm attached to the machine carriage. The carriage moves the cutting flame over the work at a predetermined but adjustable rate of speed. The torch can be lowered as the cutting progresses so that the flame is always kept at the proper height above the surface of the skull.

It's the practice at this mill to reduce the scrap material to the largest sections that can be conveniently charged into the open-hearth furnaces. By using large pieces of scrap and making fewer cuts, costs of scrap preparation are kept to a minimum.

* * *

Bouquets for Business

BY LON FANALD

R. L. AND J. G. KELLER, who do a large welding business in their shop at Fallon, Nevada, have hit upon a unique method of advertising. The Keller brothers call it the "dozen roses a month" plan.

How it works is explained by J. G. Keller:

"We pick out the best customer each month and send a card to his wife, or to his mother if he hasn't got a wife. The card says that on such and such a day we will have a dozen roses waiting for Mrs. Customer. All she has to do is to drive in and pick them up. We have never had the roses uncalled for, and we certainly get a lot of advertising from what the women say."

To avoid charges of playing favorites, the monthly gift is never given twice to the same person. If the largest customer in dollar volume is tops again for a second month, the next biggest customer is selected instead. The thing that makes the idea go over so well, say both brothers, is the contrast—the fact that you just don't expect to get a dozen roses from a welding shop.

J. G. KELLER presents top customer's wife with the "dozen roses of the month"

WELD WITH ARCOS

COMPLETE, DEPENDABLE Electrode Service

for Welding

STAINLESS STEELS

•

HIGH TENSILE LOW ALLOY STEELS

•

NON-FERROUS METALS

Only ARCOS makes a complete line of *regularly available* electrodes in stainless, low hydrogen and non-ferrous types. From them you can select the proper grade for welding straight chrome, chrome-nickel and chrome-moly steels; low alloy, high tensiles; nickel, copper-nickel and other copper or copper-base alloys.

You can depend on ARCOS electrodes for uniformity in results from pound after pound. Specialized quality control is responsible for consistently high performance. All standard grades and sizes available from distributor stocks.

SEND FOR THIS APPLICATION CHART showing types available, popular names, applications, specifications, types of coatings and color identification.

ARCOS CORPORATION
1500 South 50th St., Philadelphia 43, Pa.

Specialists in Stainless, Low Alloy and Non-Ferrous Electrodes

IT CLIMBS STEPS with ease. Secret of LeTourneau's new Tournatow is an individual electric motor to drive each wheel

BIG SPLASH rises when 61-year-old bridge span hits the Ohio River at Cairo, Ill., Nov. 9. Replacement span is at right

NEWS

Four Motors on Wheels Drive New Towing Vehicle

How a simple welded frame can be combined with motorized wheels to produce unbelievable flexibility in transportation equipment was told to members of the trade press by R. G. LeTourneau, president of R. G. LeTourneau, Inc., Peoria, Ill., at a luncheon and demonstration at the Edgewater Beach Hotel, Chicago, on Nov. 17.

Mr. LeTourneau is the inventor of the "Tournatow," a four-wheeled vehicle without clutch, transmission or differential. Instead, it has an electric motor inside of each main wheel. The four motors are connected to a d-c generator driven by a 186-hp Diesel engine.

The Diesel engine also drives an a-c generator, which supplies power to the two motors that steer the front and rear wheels. Steering is accomplished entirely by pushbutton. In the open spaces between the Edgewater Beach Hotel and Lake Michigan, the Tournatow demonstrated its extreme maneuverability, speed and climbing ability (see picture at top left).

A new concept in transportation has been realized, according to Inventor LeTourneau. Any size or shape of vehicle can be built by simply welding a suitable frame together and attaching the motorized wheels.

The Tournatow is not yet in production. The demonstration models have interchangeable wheels equipped with 56-in. standard aircraft tires. Reduction gear train, drive gear and wheel are built as units. Among other accomplishments, the vehicle has towed aircraft weighing 400,000 lb.

More Linde Oxygen From East Chicago Plant

ADDITIONAL capacity that will make its East Chicago plant the largest single producer of high-purity oxygen in the nation is announced by The Linde Air Products Company, unit of Union Carbide and Carbon Corp. This construction is part of an overall national plant expansion program.

The Linde plant at East Chicago, Ind., supplies oxygen principally to the steel and metalworking industries in a large portion of the middle west. This latest expansion is planned to provide for the extensive increase in production planned by the steel industry.

* * *

Compressed Gas Association Meets Jan. 22-23

THE 38th Annual Meeting of the Compressed Gas Association will convene at the Waldorf-Astoria Hotel, New York City, on Jan. 22 and 23. The hotel has allotted rooms for CGA members.

Old Bridge Span Pushed in Ohio River

AN 1,100-ton bridge span built 61 years ago was pushed into the Ohio river near Cairo, Ill., recently. Too light to support the heavy fast trains of today, the old 1,100-ton span was supplanted by a modern span built beside it weighing 1,760 tons. Reason for the unique method of getting rid of the old span was the contractor's desire to interfere as little as possible with the flow of traffic over the 3,900 ft of single-track bridge being rebuilt.

Building and "launching" operations were carried out by the American Bridge Co., a subsidiary of United States Steel corporation. Bridge men flame-cut the old span into scrap after it hit in the water. This splash is only the first of twelve that will take place before the bridge is reconstructed. Eleven more spans will be erected alongside old ones and then moved into place. The entire job will use about 10,000 tons of steel.

* * *

Purdue Postpones Yearly Conference

THE Purdue Welding Conference, held annually, at Purdue University, Lafayette, Ind., has been postponed until the spring of 1952.

ENGINEERING services building, Eutectic Welding Alloys Corp. This new addition to the No. 2 plant at Flushing, Long Island, will house engineering and research work

Welded Aluminum PT Boat Launched for Navy

FIRST all-welded aluminum patrol torpedo boat for the Navy, the PT-811, was launched recently at Annapolis, Md. Other aluminum PT's have been built, but were not all-welded construction.

The new boat was built at the John Trumpy & Sons shipyard, renowned in yachting circles for custom-built wooden ships. Significant to the Navy is the fact that the PT-811 is the first metal ship built by the yard. Welding techniques developed here can be used by other wood boatbuilding yards in an emergency.

Somewhat larger than the wartime "mosquito" boat, the new PT is 95 ft long with a beam of 25 ft. It will be powered by a gasoline engine. Aluminum construction was chosen by the Navy to save weight and resist corrosion. Technicians from the Naval Engineering Experiment Station at Annapolis worked out the welding and inspection procedures. The oil powder method developed by the station helped detect a few bulkhead cracks. Primary welded joints were X-rayed.

* * *

Nelson Stud Welding Expands Plant 50%

INCREASING sales and the war situation have prompted an increase of 50% in floor space and manufacturing capacity of the Nelson Stud Welding Division plant at Lorain, O. Both stud and ferrule production tools will be built.

The company will also establish its own warehouse in the San Francisco Bay area.

* * *

Metallizing Practices Published by AWS

RECOMMENDED practices and safety recommendations for metallizing have been published by the American Welding Society. Present edition includes Part 1-A, *Metallizing Shafts or Similar Objects*, and Part II, *Metallizing—Safety Recommendations.*

Topics covered include equipment, surface preparation, metallic spray bonding, rough threading, machining and blasting, electric bonding, spraying and finishing. Tables give recommended depths of undercut, machine settings for the electric bond method, weights of wire for spraying and mechanical and physical properties of sprayed metals.

American Welding Society headquarters, at 33 West 39th St., New York 18, can furnish a copy for 75c.

* * *

Weld Radiant Piping to Steel Structurals

THE first use of tack welds to hold radiant heating pipe to steel structural members has been announced. The piping is in the home of a Durham, N. C., physician.

REGO

TWO-STAGE
REGOLATOR

Precision Regulation for
OXYGEN
ACETYLENE
HYDROGEN

The precision performance of the two-stage RegOlator is especially desirable for piped distribution systems and other applications where large volumes of high pressure gases must be controlled accurately.

Two-Stage RegOlator Gives You Plus Performance!

Constant delivery pressure regardless of drop in pressure at the inlet...Patented design incorporates nozzle-type first stage counterbalanced by stem-type second stage... Triple action cartridge filter eliminates troubles usually caused by rust, dust or dirt.

Listed by Underwriters' Laboratories, Inc. and Factory Mutual.

Write for complete information.

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The BASTIAN-BLESSING Company
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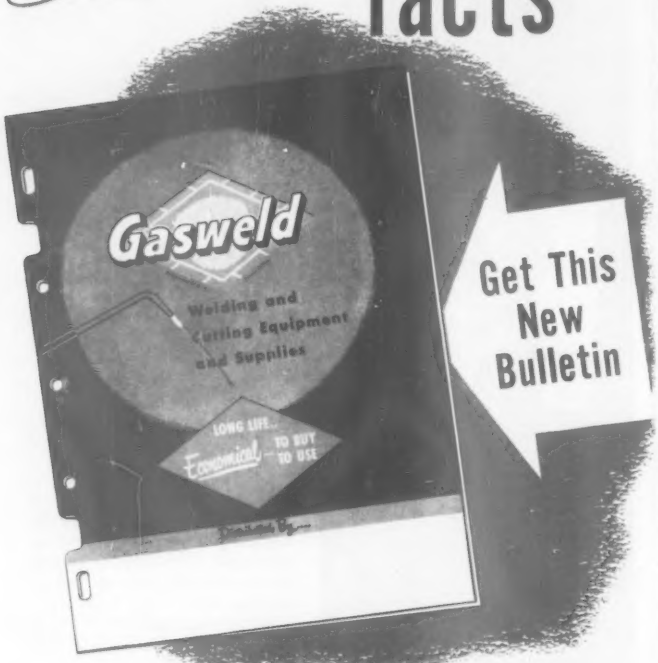
PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING HIGH PRESSURE GASES

Streamlined facts



on Gasweld's Economical Welding-Cutting Equipment Line

Ask for your copy *now!* Check! Compare! Know the advanced features of *versatile* Gasweld Equipment welding and cutting torches, complete outfits and supplies. There's a Gasweld unit for every light or heavy duty operation. Whatever the job—weld or cut with greater ease and economy with Gasweld. It's the preferred, long-life equipment for production or maintenance work in large shops or small. *Write today!*

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3100 South Kedzie Avenue • Chicago 23, Illinois

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New Program Announced for Undergraduate Awards

THE fourth competition in the Lincoln Annual Engineering Undergraduate Award and Scholarship Program lasts from June 1, 1950 to May 31, 1951. The program is sponsored by the James F. Lincoln Arc Welding Foundation.

Awards totaling $6,750 will be made for the best papers on arc-welding design, maintenance, fabrication and research.. Awards range from $1,000 to $25 for students. Duplicate awards in scholarship funds will be made to the schools where the main award winners are enrolled.

All resident engineering undergraduates registered in any college offering a degree in engineering are eligible to participate. It is not necessary to know how to weld or to be enrolled in a course of studying welding. Purpose of the program is to stimulate independent study and investigation by engineering undergraduates into arc welding.

An illustrated booklet gives suggestions, bibliography and previous award-winning papers. It can be obtained from A. F. Davis, secretary, James F. Lincoln Arc Welding Foundation, Cleveland 1.

* * *

RWMA Contest Rules Announced for 1951

$2,250 in prices will go to the winners of the best papers on resistance welding submitted in the 1950-51 contest of the Resistance Welder Manufacturers' Association.

For the best paper from an industrial source, consulting engineer or private or governmental laboratory, $750 will be given. For second and third prizes in this division, awards of $500 and $250 will be bestowed.

The best paper from a university source will win its author $300. Second prize is $200. An award of $250 will be given to the author of the best undergraduate study of resistance welding.

Closing date of the contest is July 31, 1951. Papers should be submitted to the American Welding Society, 33 West 39th St., New York City 18.

* * *

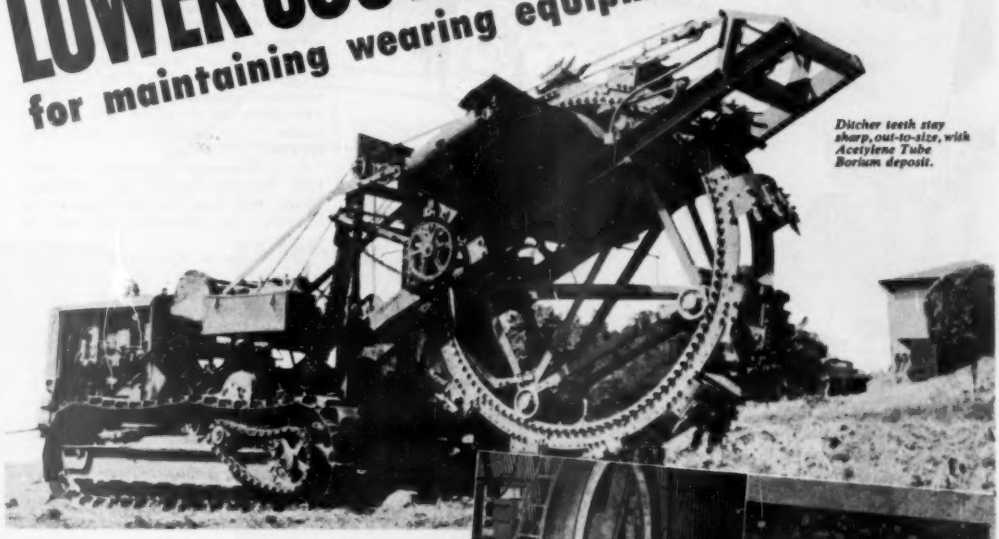
Fendall Company Joins Safety Association

Two manufacturers of safety equipment, the Fendall Company, Chicago, and the Glendale Optical Company, Inc., Brooklyn, recently joined the Industrial Safety Equipment Association, Inc.

At the same meeting, held in Chicago in October, a board of trustees was established for the first time. Members of the board include C. H. Gallaway, American Optical Co., Southbridge, Mass., association president and S. C. Herbine, Willson Products, Inc., Reading, Pa.

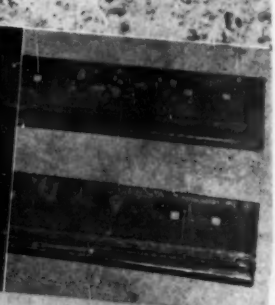
LOWER COST METHOD

for maintaining wearing equipment!



Ditcher teeth stay sharp, out-to-size, with Acetylene Tube Borium deposit.

Automatic hard-facing salvages both this 7'-6" tire and 8" trunnion.



A manual application of Stoody Self-Hardening 21 protects corners of end plates.

Clutch and brake drum faces on power take-off automatically hard-faced with Stoody 107.

Note smoothness of Stoody 105 deposit automatically applied to D-8 tractor rollers.

Automatic Hard Facing with STOODY ALLOYS

keeps parts in operation, saves time, cuts costs.

Don't junk worn parts! Tightening steel supplies and parts shortages now make it even more important to protect present equipment inventories. But here's good news: *More parts than ever, from all types of equipment, are being automatically hard-faced with Stoody Alloys.* Parts are lasting longer, users are saving money, shortage worries are being eased!

Stoody Alloys for Automatic Application double or triple part life. Application is faster and deposits are far smoother. No machining or finishing of deposits is usually necessary. Cost is naturally lowered because of increased speed. And, when hard-metal application is finally worn away, parts can be re-processed for a new lease on life!

Many shops now located throughout the country are equipped to automatically hard-face your wearing parts with STOODY ALLOYS. We will gladly furnish names of those nearest you. Write also for information on STOODY AUTOMATIC WIRES for hard-facing or see your nearest Stoody Dealer. He will gladly advise you.

STOODY COMPANY

11941 EAST SLAUSON AVENUE, WHITTIER, CALIFORNIA

The case of the cast iron PIPE CUTTER

—as related to us by an executive of Springload Mfg. Corp., Seattle, Washington.

1—"WHEN WE STARTED making this cutter, one main problem was finding a way to attach a machined bar to a piece of tubing, and adding a T handle to the tubing.

2—"WHAT MADE THE PROBLEM more tricky, the joints had to take severe stresses—both rotary and tensional. It was without solution until your representative demonstrated EASY-FLO low temperature silver alloy brazing.

3—"WE'VE BEEN DOING THE JOB with EASY-FLO for over two years now. It gives us the strong joints we need and also meets all our production requirements.

4—"THESE TOOLS CUT cast iron soil pipe, water pipe and Duriron pipe from 2" to 12" sizes. ALTHOUGH THERE ARE many thousands of these tools out and they are usually used under rough conditions, we have yet to encounter any difficulty from the EASY-FLO brazed joints."

The Same Service is Yours—Anytime

• We maintain a corps of thoroughly trained and experienced specialists just to show manufacturers what our low-temperature silver brazing alloys can do on their work and to help solve specific problems. We'll be glad to send one to your shop—anytime—without cost or obligation. The new BULLETIN 20 gives the full story about the alloys and the valuable services that go with them. Write for a copy today.

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West Central NWSA Meets at Des Moines

VALUABLE discussions marked the west central zone meeting of the National Welding Supply Association, held at the Hotel Kirkwood, Des Moines, Ia., on Nov. 15. The 33 manufacturer and distributor delegates agreed that fruitful ideas resulted from the talks.

Walter G. Lofgren, vice-president in charge of the west central zone, and president of the United States Welding Works, Denver, opened the morning session. He was followed by Glenn G. Garman, national president of NWSA, who gave an excellent talk on the values of membership in a trade association.

L. J. Weisgerber, president of Mankato Welding Supply Co., Mankato, Minn., told how his firm controls its inventory for efficiency and ease of handling.

The National Production Authority regulations and DO (Defense Order) ratings were explained by George C. Payne, regional director of the Department of Commerce, Chicago. Many distributors were interested in this talk since it closely involves welding equipment. Copies of the regulations can be obtained by writing to the Department of Commerce, Division of Printing Services, Room 6225, Washington 25, D. C.

Allen H. Young, manager, Independent Distributing Co., St. Joseph, Mo., gave his ideas on what is essential in manufacturers' catalogs, price sheets, sales manuals, advertising and direct mail literature.

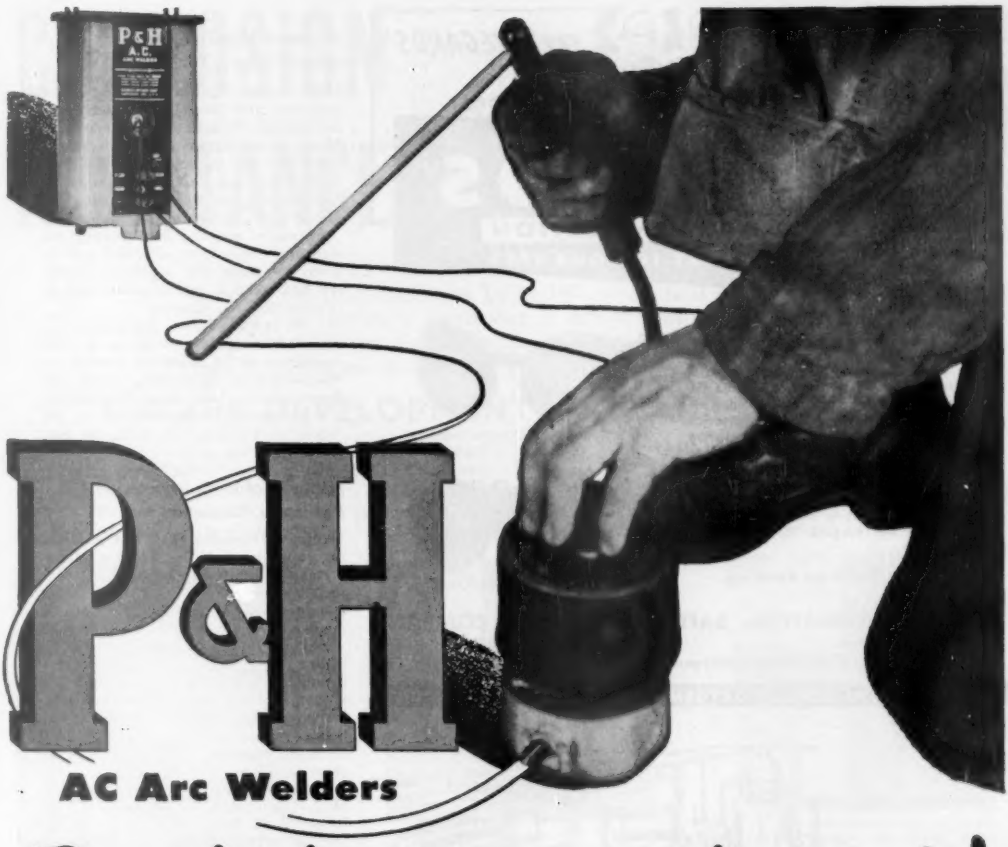
The problem of manufacturer's competition was discussed by C. S. Rutherford, secretary-treasurer, R & R Welding Supply Co., Des Moines, Ia.

Rental of welding equipment was the subject of the talk by W. A. Juergens, secretary, Machinery and Welder Corp., St. Louis, Mo. One reason this service is profitable, Mr. Juergens said, is the rental-purchase agreement used —the renter can apply his rent money toward purchase of the welder.

Bill Schneiderwind, president, Omaha Welding Co., Omaha, Nebr., told how his company keeps up good customer relations. He specifically mentioned the roles of his employees, mail contacts, salesmen, advertising, filling of orders, substitution on order and merchandise not handled.

Mr. Garman returned for the last talk of the day. He stressed the importance of aggressive merchandising of welding equipment: this includes checking of parking facilities for customers, outside store appearance, interior appearance with visual merchandising, a good stock of merchandise advertising and reading of trade journals and trade association news.

Three visitors signed membership applications: L. W. Skoglund, Skoglund Welding and Supply Co., Minot, N. D.; W. H. Osmundson, president, Osmundson Spade Mfg. Co., Inc., Perry, Ia., and Sloane Allen, president, The Baum Iron Co., Omaha, Nebr.



Turn the heat on – at the work!

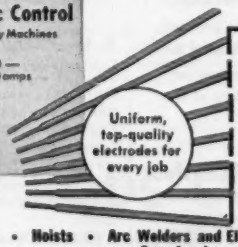
Exclusive Dial-lectric control saves time and motion, cuts your welding costs

P&H built-in remote control puts heat selection just where your operators want it — at the work. Walking time is turned into welding time. Mount the welder on the wall—save valuable floor space. Welding is faster, sounder, better looking. Production goes up, costs go down.

Additional features are: Easy quick-start arc. Elimination of arc blow. No moving parts to cause delays or maintenance expense. High electrical efficiency that reduces power costs. NEMA rated.

See your P&H representative or distributor for full details.

Model TH-500 — Range 40 to 650 amps
Model TH-300 — Range 30 to 400 amps
The only Complete Line of AC Welders with Dial-lectric Control
Also complete line of High-Frequency Machines
Model TI-200 — Range 30 to 275 amps
Model TI-150 — Range 20 to 190 amps



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AND GET MORE PROTECTION FOR LESS MONEY

THE ORIGINAL CHAMPION

EYEGARDS

WITH 10-WAY VENTILATION

BEST THING NEXT TO YOUR EYES

Giving your men the finest in eye protection doesn't mean you have to pay premium prices. Get Eyegard goggles and save the difference! They're the goggles that provide greater comfort because the lightweight plastic frame is molded to form-fit the face . . . greater protection because the goggles are impact-resisting . . . greater ventilation through three large vents at side of cup and seven additional vents around the lenses. Cool and fog-free. With all their exclusive features, they cost no more than ordinary goggles. Get Eyegard "Champions" on next order.

Write for free catalog.

No. 31 Grinders and Chippers Goggles

No. 335 Welders Coverspec Goggles

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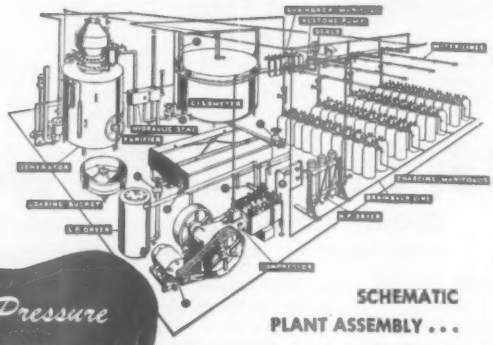
3503 Lakeside Avenue Cleveland 14, Ohio

Division of the Burdett Oxygen Company, Cleveland, Ohio

DIVISION OF THE BURDETT OXYGEN COMPANY • CLEVELAND, OHIO



A *Low Pressure* ACETYLENE PRODUCING PLANT that Charges up to 160 CYLINDERS at ONE TIME

SCHEMATIC PLANT ASSEMBLY . . .

showing placement of the various units that comprise the plant.

This plant layout provides for *extremely* simple operation and exceptionally *low* maintenance costs. Ample storage space is also provided for filled tanks. Being compactly designed the chief operator has all operations under surveillance at all times. Rated capacity of this assembly is 2700 cu. ft. per hour.

We invite your inquiries

INDEPENDENT ENGINEERING COMPANY, Inc.

Manufacturers of

CONSULTING • DESIGNING • RESEARCH

CYLINDERS AND GAS PRODUCING EQUIPMENT

ACETYLENE • OXYGEN • HYDROGEN • NITROGEN

O'Fallon, Illinois

Western Metal Show Set for March 19-23

More than 200 firms will show new products and latest developments at the seventh Western Metal Exposition, March 19 to 23, 1951 at Oakland, Calif. The show will be housed in Oakland's Auditorium and Exposition Hall. It is sponsored by the American Society for Metals and 20 other technical societies.

Papers on welding, heat treating, design and application of metal will be given by some 100 speakers. Theme for both exhibits and speakers will be "Production for America."

E. A. Daniels, Victor Equipment Co., San Francisco, is serving on a local committee of the American Society for Metals that is anticipating needs and developments of the show. Mr. Daniels is also special representative of the American Welding Society on the general committee.

* * *

Miller Holds Conference For Sales Managers

The new expanded sales and advertising program of Miller Electric Manufacturing Co., Appleton, Wis., was recently presented to division sales managers in a five-day meeting at Appleton.

Among those present were N. C. Miller, president; C. B. Abel, sales manager; A. E. Harrant, executive assistant; J. H. Mulder, secretary; G. K. Willecke, physicist; R. C. Breth, advertising counsel; W. L. Sykes, chief electrical engineer, and A. C. Mulder, plant manager.

Division sales managers included M. J. Van Dresser, F. W. Spear, C. M. Selser, B. R. Baker, F. H. Beck, R. M. Metcalf, C. J. Bocklet, C. L. Malott and W. H. Siefferman. Other men from the sales department were W. B. Rea and E. D. Wagner.

* * *

Murex to Make Electrodes in Australia

Murex Limited, of England, will build modern factory and research facilities for electrode manufacture at Derwent Park, Hobart, Tasmania, an island off the coast of Australia. Branch offices will be established in all Australian state capitals and later in New Zealand. E. J. Clarke, director and development engineer of Murex Welding Processes Ltd., is now in Tasmania to advise on the new plant.

—*McGraw-Hill World News*

* * *

T. B. Jefferson Makes Commencement Speech

Principal speaker scheduled at commencement of the Milwaukee School of Engineering on Dec. 22 was T. B. Jefferson, editor of The Welding Engineer. Mr. Jefferson was recently appointed a member of the school's industrial committee of the welding institute.

Some 59 students were scheduled to receive degrees or certificates.

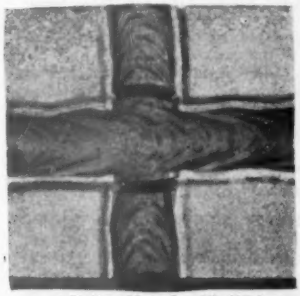
CORROSION RESISTANCE *Without* COLUMBIUM

If you have had difficulty in obtaining columbium stabilized welding electrodes such as Type 347, you'll find Arcaloy ELC (extra low carbon) electrodes a suitable alternate. Service tests have proven these electrodes equal to stabilized grades and far in excess of ordinary grades.

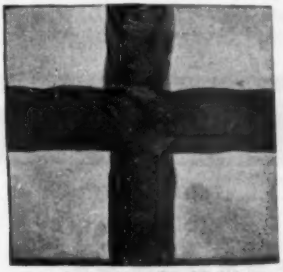
5 YEARS DEVELOPMENT - 2 YEARS IN SERVICE

As the leading manufacturer of stainless steel welding electrodes, Alloy Rods Company went to work on the problem of eliminating the necessity of Columbium in arc welding as early as December 1945.

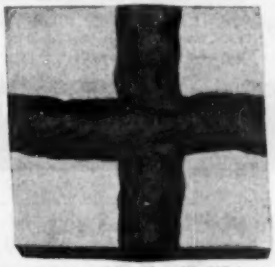
Since June 1948, Arcaloy Type 308 ELC (Extra Low Carbon) and Arcaloy Type 316 ELC Electrodes have been used on many weldments in various industries and have proven satisfactory under service conditions.



• Butt weld made with ½" type 304 plate and welded with type 308 electrodes. NOTE dark bands of corrosion due to carbide precipitation in heat affected zones.



• Butt weld made with ½" type 347 plate and welded with type 347 electrodes. NOTE absence of corrosion in heat affected zones, when Columbium stabilized plate and electrodes are used.



• Butt weld made with ½" type 304 ELC plate and welded with 308 ELC electrodes. NOTE absence of corrosion in heat affected zones, when ELC plate and ELC electrodes are used. Compare with type 347 weld (center.)

• Actual size — as welded. Etched 12 hours in 10% nitric — 3% hydrofluoric acid solution at 175° F. Photographs courtesy ARMCO Steel Corp.

CARBON CONTENT IMPORTANT

Arcaloy Types 308 ELC and 316 ELC (Extra Low Carbon) electrodes produce weld deposits containing .03% maximum carbon. In order to achieve complete immunity to inter-granular carbide precipitation in unstablized austenitic alloys, carbon content must be reduced to less than .02%. However, it has been determined that *material containing .03% maximum carbon content will possess sufficient immunity* to safely withstand temperatures in the carbide precipitation range for reasonable periods of time.

ARCALOY 308 ELC and 316 ELC

Arcaloy Type 308 ELC electrodes will weld stainless types 321 (titanium stabilized) and 304 ELC without appreciable carbide precipitation. Arcaloy Type 316 ELC electrodes will weld stainless Type 316 stabilized and 316 ELC plate without appreciable carbide precipitation.

Get all the facts on these new Arcaloy electrodes by writing for a copy of "Arc Welding Stainless Steel Without Columbium."

ALLOY RODS CO.

YORK, PENNSYLVANIA

THE QUALITY LINE IN THE

STEEL CONTAINER

Moisture, dirt and grease proof. Easy to stock.

FAST ON-THE-SPOT REPAIRS

With This Portable Welder!

This inexpensive "Lincwelder", made by Lincoln Electric Co., Cleveland, O., is easily mounted on running gear or truck for welding service anywhere.

Welding at the breakdown-scene . . . adds up to savings in time and labor with this light but rugged 180 amp. Lincoln Welder, powered by a two-cylinder Wisconsin Heavy-Duty Air-Cooled Engine.

The performance satisfaction of Wisconsin Engine power increases not only the reliability of equipment in all fields, but also increases the confidence of both equipment user and builder. They're sold on such features as self-cleaning, thrust-absorbing Timken tapered roller bearings at both ends of the crankshaft . . . fool-proof air-cooling, from sub-zero to 140°F . . . an easily serviced OUTSIDE rotary type, high tension magneto with impulse coupling, for quickest any-weather starts . . . plus heavy-duty construction, inside and out.

Your investigation is invited! 3 to 30 hp., 4-cycle single-cylinder, 2-cylinder, and V-type 4-cylinder models.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy Duty Air-Cooled Engines

MILWAUKEE 46 WISCONSIN

Safer...at no added cost

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Safe-T-Chek REGULATORS

The MECO Safe-T-Chek is the only regulator with a *built-in*, self-actuating safety valve that controls excessive pressures due to careless handling or failure of seating. This *built-in* safety feature comes to you at no additional cost. See your MECO Dealer TODAY.

FREE—Write for your copy of the NEW MECO Catalog No. 140 TODAY.

Meco "Always specify MECO . . . the finest in the field"

Modern Engineering CO., Inc.

3411-D PINE BLVD. ST. LOUIS 3, MO.

Big Crowd Attends Weldfest at St. Joe

More than 800 job shop owners, welders, farmers, manufacturers and friends visited the fourth annual "Weldfest" held by Independent Distributing Co., St. Joseph, Mo., on Dec. 7 and 8. Manager Allen H. Young provided two busy afternoons full of welding ideas and information, starting at 1 p. m. and ending at 9:30.

On Thursday, Dec. 7, silver brazing was demonstrated by Matt H. Wigton, Goldsmith Bros. Smelting and Refining Co., Chicago. Pipe welding was discussed and performed by Bob Bercaw, Hobart Bros., Troy, O. Fire protection and oxyacetylene welding were shown by American-LaFrance-Foamite Corp. and Puritan Compressed Gas Corp., respectively.

Friday's program was led off by welding of plowshares by V. L. Buckles, Osmundson Spade Mfg. Co. Mr. Wigton gave another silver brazing show. E. S. Wheeler, Shawinigan Products Corp., discussed maintenance of acetylene generators. George M. Hohmann of Alloy Rods Co. demonstrated stainless and cast iron arc welding. Mr. Bercaw welded pipe again for spectators in the day's last session.

In addition to welding demonstrations, there were six movies, door prizes and a tour of the local naval reserve training center.

* * *

Airco to Build Plant at Union, N. J.

A 272,000 sq ft factory for making welding and cutting equipment, arc welders, regulators, oxygen and acetylene manufacturing and distributing equipment will be built this spring by Air Reduction Company at Union, N. J. About 800 people will work in the finished plant.

Built on a 25-acre plot, the factory will be of brick and steel. It is of one story construction except for 18,000 sq ft of office space.

* * *

Cold Welding Used in X-Ray Manufacture

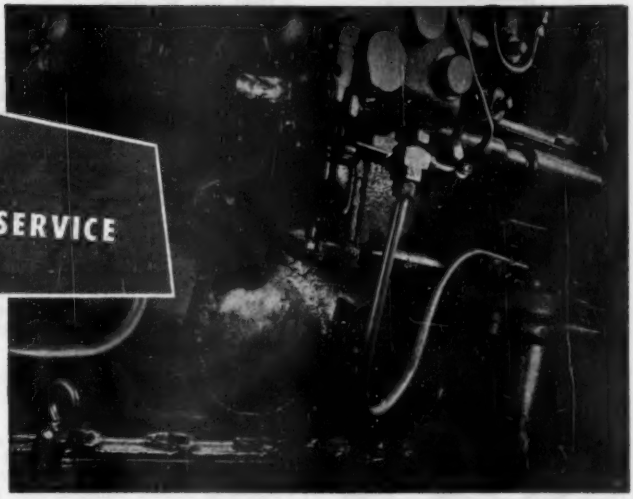
The ionization chamber of a new "Watson" deep therapy X-ray machine built in England was assembled by cold pressure welding. This type of welding was developed by the General Electric Co. Ltd., London.

The chamber is made of two slightly dished circular aluminum plates, ribbed for rigidity. Using the special dies necessary for cold welding, the plates are ring welded together so that air at a slight pressure is trapped between them. A third plate is held between the two outer plates.

When the chamber is placed across the path of the X-ray beam, the air is ionized and will conduct electricity. Reason for cold welding is that the chamber is sealed hermetically without any great temperature rise.

—McGraw-Hill World News

$1800 SAVED...
7500 HOURS MORE SERVICE
...from truck engines repaired with NI-ROD



IN THE open-pit nickel mines at Copper Cliff, Ontario, Diesel trucks haul 32-ton ore loads up steep, winding roadways.

After several thousand hours of this severe service, failures develop in engine parts, failures such as the cracking of cast iron cylinder blocks. New engine blocks cost $644.09 each . . . a price that makes the prospect of repairs very attractive.

In the past, damaged blocks have been repaired by oxy-acetylene welding. But recently, repairs have been made with metal-arc welds, using Ni-Rod* electrodes. This technique has been completely successful, resulting in excellent weld quality and reduced welding time.

Here are three typical case reports on repairs made with Ni-Rod:

"1. Block broke in crank chamber after 9381 hours of service. A patch was welded in with Ni-Rod. Since the repair, the block has operated 2064 hours and is still in good condition. Cost of welding was $12.75.

"2. Crank shaft failed after 1746 hours. The broken end engaged the main bearing shells, turning them in the block, heavily scoring the saddle. Repairs were made by machining the bearing area to .100-inch oversize, building up with Ni-Rod, and finally machining to correct size. This prolonged the engine life by 4087 hours. Cost of the entire repair was $40.60.

"3. Crank shaft failed after 4540 hours, causing damage similar to that described in Case 2, above, and was repaired the same way. The engine is still in operation 1369 hours after the repair. The cost of repair was $42.50."

The three blocks described have a total replacement value of $1,932.27. Subtracting the repair costs, there is a net saving of $1,836.42, and a gain of more than 7520 hours of operating service.

Send for your free copy of: "NI-ROD—A New Electrode for Any Cast Iron Welding."

Although Nickel and Nickel Alloys are currently in short supply, Inco advertisements will continue to bring you information on industrial processes and developments, which we believe will be of interest.

• • •

HERE'S WHAT NI-ROD GIVES YOU

In performance
- Stable arc in all positions
- Excellent wash
- Preheating seldom required
- Works on both AC and DC

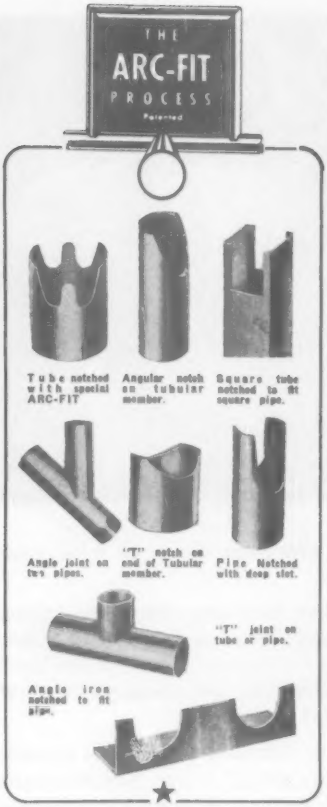
In weld quality
- Easy machinability
- Thorough fusion
- Freedom from cracks and porosity

In usefulness
- General repair cast iron parts, including build-up of worn surfaces
- Quick remedy for flaws in new castings
- Correction of machining errors
- Assembling cast iron to steel

EMBLEM OF SERVICE INCO

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

*Reg. U. S. Pat. Off.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ARC-FIT
PROCESS
Patented
Tube notched with special ARC-FIT
Angular notch on tubular member.
Square tube notched to fit square pipe.
Angle joint on two pipes.
"T" notch on end of Tubular member.
Pipe Notched with deep slot.
"T" joint on tube or pipe.
Angle iron notched to fit pipe.

TOPS IN SHOP EFFICIENCY

5 seconds to notch Tubing and Pipe Ends

The answer to many problems confronting large and small shop owners. No shop can afford to be without the ARC-FIT—no matter how large or how small. Manual or power operated—fits the ARC-FIT hand press or any standard power press.

ARC-FIT is a patented precision-built shearing tool which prepares the ends of tubing or pipe to produce welded or brazed tubular "T" or angle joints. ARC-FIT will not deform the tube or pipe and no further finishing is required—no sawing, cutting, or removing sections with milling cutters. Our literature gives many fine points on operation, construction, and application—send for it today —also write for quotations.

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2527 W. MOFFATT ST.
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CHICAGO 47, ILLINOIS

Brr! Arc Welding at 65 Below Zero

In a special cold room, Hobart Brothers Co., Troy, O., is testing its welding and electrical generating equipment under sub-zero conditions. Temperatures as low as 65 below can be produced.

The testing equipment includes: a graphic thermometer for charting ambient air or room temperature through a range of —100 to plus 100 F; an indicating potentiometer having 24 stations and a range of —100 to plus 1,200 F; a two-way sound system connecting observers inside the cold room and technicians outside; an inspection window with six panes of thermo-glass to maintain insulation.

* * *

Alabama Trade School Celebrates 25th Year

Twenty-five years of growth and achievement were recently marked by an anniversary celebration at Alabama School of Trades, Gadsden, Ala. The campus of the school now covers more than 500 acres and includes 18 permanent buildings. There are 61 people on the staff and faculty for an annual enrollment of 500 students.

The welding and sheet metal shop is an important part of the school's 18-trade training program. It is in charge of C. E. Korner, veteran weldor and pipe fitter. His experience includes railroad, plumbing and job shop work. Several of his students now head welding and sheet metal departments in trade schools around the country.

* * *

M. W. Kellogg Opens Canadian Piping Shop

A new shop for pipe fabrication was recently started in Edmonton, Alberta, by Canadian Kellogg Ltd. The shop has a monthly capacity of about 400 tons. It will handle not only carbon-steel and low-chrome piping but also stainless steel and high-nickel alloys in a full range of pipe sizes.

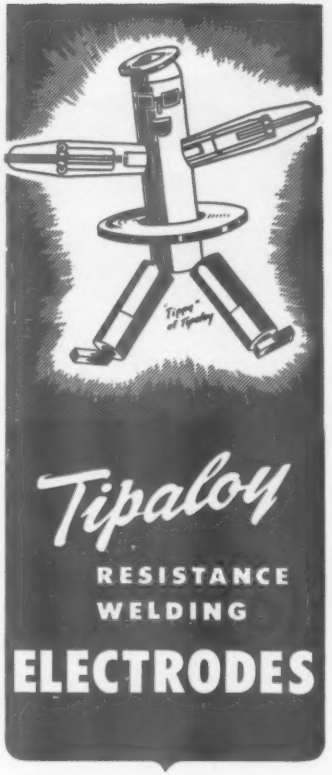
Reason for the new plant is given as the growing use of high-temperature, high pressure piping by major American utility companies. The Canadian company is a subsidiary of M. W. Kellogg Co., engineering and fabricating firm of New York City and Jersey City.

* * *

Columbus Distributor Opens for Business

Frank P. Denzel, well known welding man in the Columbus, O., area serves as president of a new welding supply business in the Ohio capital, the Franklin Supply Co. Headquarters are at 1260 West Mount St., Columbus.

The new firm will handle both gas and arc welding equipment. A fleet of trucks will make pick-ups and deliveries of welding gases and supply to customers. Stockpoints will be located at Zanesville, Delaware, Lancaster, Newark and Coshocton, O.



- **Longer life.**
- **Less redressing.**
- **Less mushrooming.**
- **Greater current density.**
- **Extraordinary continuous service under heavy production stresses.**
- **Cuts production costs, yet costs no more than the ordinary electrode.**

Write today for test samples and "The Story of STRAIGHT LINE Conductivity."

Tipaloy INC 1435 E. MILWAUKEE DETROIT 11, MICHIGAN
Offices in Principal Cities

You can save money with this

M 38 CUTTING TORCH

because it gives you TOP PERFORMANCE

AT A MODERATE PRICE!

Solid Monel Head
Tough, distortion free. Impervious to flashback!

K-G "Balanced" CUTTING TIP Wide range available for all fuel gases. *Each* tip flame-tested.

SENSITIVE HIGH PRESSURE CONTROL. Top or bottom lever, lock nut if desired.

HIGH TENSILE NICKEL SILVER TUBES. Durable, trouble-free. Take a beating, keep working!

"Easy-grip" FORGED HANDLE. Tough — but comfortable, fatigue-free.

WIDE-SPACED NEEDLE VALVE HANDLES. Easily manipulated — even when wearing heavy gloves!

"What Do You Need In a Cutting Torch to Get 'Fastest Production at Lowest Cost?'

"We found out that first you have to get torches that are *balanced right*—have the right 'feel.' Then, of course, they have to be *easy to operate*. Needle valves too close together, tips that spit and cough, tip nuts that leak—that kind of trouble holds down any burner's production rate.

"Cutting torches have to be *tough*, too. Sometimes a burner won't bother with his hammer, but knock apart a finished job with the head of his torch—so that torch better be able to take it.

"Those are the qualities that we looked for in a cutting torch—and we didn't want to pay the moon for them.

"The answer for us was the K-G M 38. It has the extras that we need: rugged construction with real durability, better balance and superior operating characteristics. And the few dollars our M 38's cost over cheaper torches has been made up a hundred times by increased production, and lower maintenance and replacement costs!"

Write today for your copy of the K-G Catalog. It shows the complete K-G line of welding and cutting equipment—designed to give you *fastest production at lowest cost.*

K-G

A unit of Air Products Inc. OXYGEN GENERATING EQUIPMENT

THE K-G EQUIPMENT COMPANY

515 West 29th St., New York 1, N. Y.

Sold in Canada under the name "WELDCO"
by Welding and Supplies Co., Ltd., Montreal and Toronto

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

K-G ...Since 1914, symbol of satisfaction on GAS WELDING AND CUTTING EQUIPMENT

Fully Re-Galvanizes Welds ....At Lower Cost

GALVALLOY

EASY TO APPLY!

Merely heat surface and

brush it on. Excellent, too, for filling blow holes and repairing corroded areas.

Bonds so strongly you can't burn it off. Galvalloy covers completely—without use of flux.

Saves you money—Galvalloy will not flow off as waste even when surface is heated cherry red. A little goes a long way.

High corrosion resistance—withstands a 30-day salt-spray test.

Galvalloy bonds perfectly to steel, cast iron, aluminum, magnesium and pot metal. No sand-blasting or cleaning needed. Used in repairs and fabricating. Write for literature and prices.

JOBBERS:
Better profits in Galvalloy.
Write for details.

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WELDING CATALOG PUBLISHERS
600 West Jackson Boulevard **Chicago 6, Illinois**

Government Control on Metals Still Only Cutbacks

TIGHTENING government controls on basic materials, especially metals, still are aimed at cutbacks in non-defense fabrication. It's likely that materials will also be made available for research and development in the all-out allocation program yet to come. All indications show it is no time to try mass production of new items using scarce materials or that have no direct or indirect value to the mobilization effort.

The National Production Authority, which has the major responsibility for administering industrial controls, drew up a list of critical materials as one of its first acts. The list includes most metals, rubber, nylon, rayon, lumber, cement, alcohol, chlorine, glycerine, soda ash, etc.

First controls device, the DO (Defense Order) system, was authorized by NPA to get needed material to the military, Atomic Energy Commission and other defense agencies. It also assigned DO numbers to groups in the several defense agencies, leaving each to assign procurement categories for their several numbers.

Two "basket" designations were established, DO-98 for production equipment, including welding equipment, and DO-99 for shelf items and others required in small amounts. Other assignments by defense agencies are: Department of Defense, (DO)-01 aircraft, -02 guided missiles, -03 ships, -04 tank-automotive, -05 weapons, -06 ammunition, -07 electronics and communications equipment, -08 fuel and lubricants, -09 clothing and equipage, -10 transportation equipment, -11 building supplies and equipment for overseas construction, -12 subsistence, -21 miscellaneous and -22 construction (contract); Atomic Energy Commission, (DO)-40 operations, -41 construction (other than equipment), -42 construction equipment, -43 contractors' privately owned facilities, -44 other privately owned facilities.

Since the Chinese entered the Korean fighting, there will be less consideration by NPA of "hardship cases," even those claiming the restrictions are causing unemployment. There must be some unemployment as the economy shifts into high-gear mobilization, is the official attitude.

* * *

Inert-Gas Spot Welding Used in UN Building

OFFICE doors in the glass, steel and masonry United Nations building were partially built by inert-gas spot welding. The special spot-welding torch was used to weld filler strip into the space around a single window in the doors, the flush edges and the hinges.

Welds were made from one side without backing. Time for each weld, made in thin-gage cold-rolled steel, was 2½ seconds. Fabricator of the doors was The Atlantic Metals Product Company, Long Island City, N. Y.

ELECTRODES

cut welding costs all along the line

OPERATOR

"easy to use"

"I like G-E rods because they are easy to use—I can make more welds per day. And no matter what sort of welding work I have to do, ordinary or special, there's always a 'right' G-E rod for the job."

WELDING ENGINEER

"excellent mechanical properties"

"We can more than meet our specifications by using G-E electrodes. They have excellent mechanical properties—high tensile strength, good ductility, and soundness."

PLANT MANAGER

"for fast and economical production"

"Our plant aims for fast, economical and quality production. At the same time, we want to keep our operators happy with the tools we provide. We chose G-E electrodes because they do both jobs."

PURCHASING AGENT

"high quality product at right price"

"By using G-E electrodes we get a high quality product at the right price—and get it promptly. We can get prompt service right from our local distributor."

Order arc-welders, electrodes, accessories, and renewal parts from your G-E Welding Distributor. For more information, write: Apparatus Dept., General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC

711-14

SPATTER
Doesn't
MATTER...
ON A HARGRAVE
WELDERS'
CLAMP

NO. 41 LIGHT SERVICE

NO. 45 DEEP REACH

NO. 43 HEAVY SERVICE

SPRING CLAMP
For spot welding and other light duty welding. Holds firmly, releases instantly. Useful where speed is needed. Every shop needs a few.

INDIVIDUALLY TESTED

Hargrave Nos. 41, 43 and 45 Welder's Clamps resist spatter permanently because the Patented screws are made of an anti-spatter, solid alloy material—not to be confused with ordinary plated types of screws. They speed your work . . . ease the job and give years of trouble-free service. Frames are forged steel, heat-treated and designed to give greatest strength for weight. Oscillating (ball and socket) tip is put on to stay. Each clamp is Individually Tested. Openings in all popular sizes.

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showing the complete line of Hargrave Individually Tested Clamps, Chisels, Punches, Star Drills, Brace Wrenches, File Cleaners, Washer Cutters, etc.

There is an Industrial Distributor Stock near you.

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1944 Waverly Ave.
Cincinnati 12, Ohio
The Cincinnati Tool Co.

Book Reviews

Welding Design

INTRODUCTION TO MECHANICAL DESIGN. By T. B. Jefferson and Walter J. Brooking. Published by Ronald Press Co., New York, 1951. Cloth, 5½x8½ in., 612 pages. Price $6.50.

If weldments are to be fabricated in the most economical manner, the process must begin on the drafting board. A most useful book to help the designer has just been published.

In this volume, the authors have prepared a textbook of theory and practice that closely follows the mode of creative thinking of the engineers who actually design machines. The subject is approached in the light of the functional purpose of the machine, its configuration requirements, economic considerations, the use of rational and empirical design data and desired final appearance.

Coupled with this background, the book presents the elemental theory of machine elements, accomplishing its double objective of presenting both basic and applied aspects of the subject. A number of design considerations that do not commonly figure in most machine design texts are also discussed.

Special emphasis has been placed on such newer processes as welding and die casting and new materials in machine construction. Many tables are included to make *Introduction to Mechanical Design* a comprehensive reference and handbook.

This book won first prize in the Machine Design Division of the Engineering Textbook Awards made by the James F. Lincoln Arc Welding Foundation. Both of its authors are well known in the welding industry.

* * *

Economics

ENGINEERING ECONOMY. By H. G. Thuesen. Published by Prentice-Hall, Inc., New York, 1950. Cloth, 5½x8½ in., 501 pages. Price $6.65.

Though it is designed as a college text, all engineers in industry can profitably read *Engineering Economy*. As the author points out, engineering is essentially a means of obtaining specific results in the most economical manner. For this reason the engineer must approach engineering problems with due regard for economic implications as well as physical considerations.

Especially timely today are those chapters discussing depreciation and depreciation calculations; initial, fixed, variable, increment, differential, marginal and sunken costs; breakeven and minimum costs; economy of operations.

The engineer who aspires to a creative rather than a responsive role in his work will find that proficiency in economic analyses is a necessity. Particularly is this true of large numbers of engineers nowadays engaged in business management. Answers to the needs of such men will be found in *Engineering Economy*.

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BRAZING FLUXES

• Have the assurance of the best kind of job with least cost . . . use ANTI-BORAX Products. Their importance can in no way be gauged by their low cost. Every metal fabricating plant in the country needs one or more of the ANTI-BORAX Products. They give certainty and economy on such jobs as making special tools, production work, or repair jobs. Send for descriptive circulars and ask for free sample.

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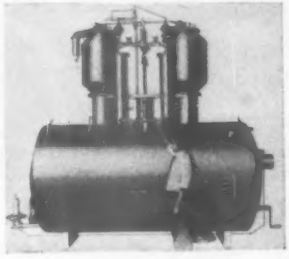

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West Alexandria, Ohio, U.S.A.

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a NEW line of Page-Allegheny AC-DC Stainless Steel Electrodes

they're NEW

... ***BUT*** they've been "given the works" by many large fabricators of stainless steel equipment—on the job. And, from all reports, they're the most all 'round satisfactory electrodes PAGE ever developed for any kind of weld on any type of stainless steel. And PAGE has been making stainless steel electrodes since the early development of stainless.

Ask your Page distributor about these new, improved Stainless Steel Electrodes

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Rebuild...Repair TRACTOR PARTS with MANGANAL

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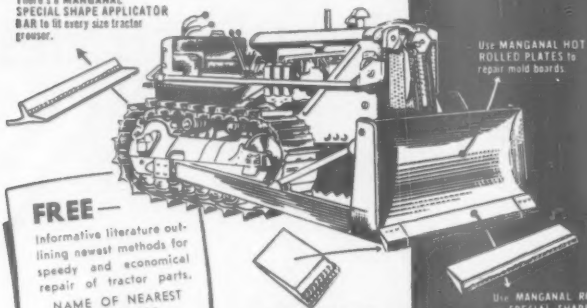
USE MANGANAL BARE ELECTRODES to rebuild worn drive sprockets, track rollers and idler wheels.

There's a MANGANAL SPECIAL SHAPE APPLICATOR BAR to fit every size tractor grouser.

Use MANGANAL HOT ROLLED PLATES to repair mold boards.



FREE— Informative literature outlining newest methods for speedy and economical repair of tractor parts. NAME OF NEAREST DISTRIBUTOR UPON REQUEST

Use MANGANAL FLAT APPLICATOR BARS to repair worn corner bits.

Use MANGANAL ROUND or SPECIAL SHAPE APPLICATOR BARS to repair EDGE OF BLADE

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WELDING TORCH W-45
Strong and sturdy, 14 inches long, yet weighs only 17 ounces. Lock control for continuous welding. Cuts oxygen and acetylene costs one-third.

BLOWPIPE C-47
Aluminum alloy construction... good balance, comfortable grip. Closed hand releases gas ... open hand cuts it off. Reduces idle flame fire hazard. Works perfectly with natural gas, manufactured gas, butane and compressed air.

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Has long lever for closed hand or fingertip gas control, allows wider operating range. Weight, 14 ounces; length, 13 inches.

Meet all Underwriters Requirements

Weldimatics

... are daily cutting costs, reducing fire hazards in many of the world's largest industrial plants. Some distributor territory still available. Write today for descriptive bulletin.

992 OAKMAN BLVD. Weldit INC. SINCE 1919 DETROIT 6, MICH.

About People

VERNE W. BENDER has been named regional manager for the western states for Nelson Stud Welding Division, Morton Gregory Corp., Lorain, O. AL BOSLEY will be Nelson field engineer for northern California. GEORGE E. KENNEDY is field engineer for southern California.

* * *

HOWARD L. TIMMS has joined Harnischfeger Corp., Milwaukee, as general manager of both P&H plants at Escanaba, Mich.

* * *

S. E. BIGGS, Cincinnati and JAMES A. BARDSLEY, Berkeley, Calif., have been elected vice-presidents of The Trailmobile Co., Cincinnati.

* * *

PROFESSOR MINORU OKADA, welding educator from Japan recently visited the offices of Eutectic Welding Alloys Corp., New York City. Another Japanese citizen, J. IWAI, chief of the welding shops at Nagasaki Shipyard & Engine Works, Nagasaki, Japan, also recently visited welding manufacturers and installations in this country.

* * *

ED SHERRICK, has been named chief engineer, Western Arc Welding, Inc., Los Angeles. He was formerly with Viking Supply Company, Los Angeles and with Rheem Mfg. Co. at Pasadena, Calif.

* * *

RICHARD SCHWARZCHILD has been appointed assistant to the president, American Silver Co., Inc., Flushing, N. Y.

* * *

THOMAS C. GRAY has been named director of engineering for Pullman-Standard Car Mfg. Co. During World War II, he was a Navy captain with the post of industrial manager of Guam.

* * *

L. M. RICH has been appointed vice-president and general sales manager of the Plomb Tool Co., Los Angeles.

* * *

ALLAN W. WALTER has been elected comptroller of Pullman, Inc. Since 1948, Mr. Walter has been with The Liquid Carbonic Corp., as financial vice-president.

* * *

CAPTAIN J. V. MURRAY, advertising manager for Miller Electric Mfg. Co., Appleton, Wis., has been called into active duty with the armored forces at Fort Knox, Ky.

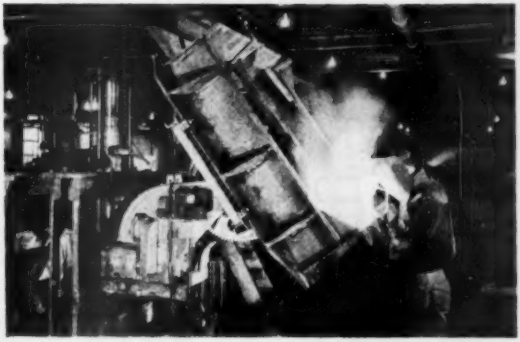
* * *

J. H. KING has been elected president of The Society of Naval Architects and Marine Engineers.

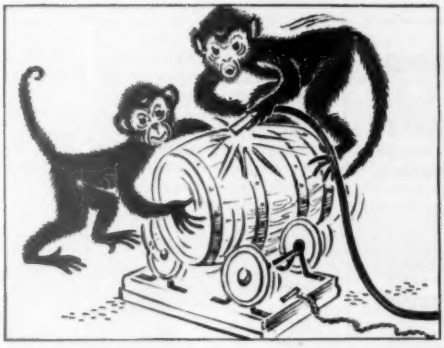
You're Smart Like a Fox...

when you increase arc-time per hour with Worthington-Ransome Welding Positioners and Turning Rolls.

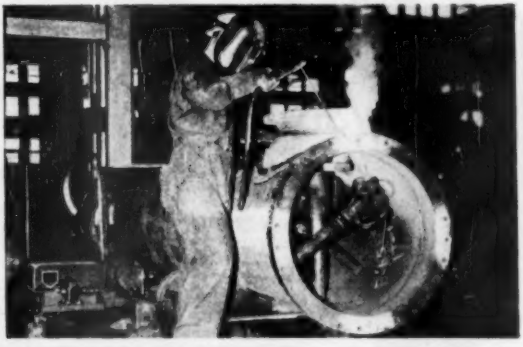
Not this... Spare your welders the chore of having to *climb* all over the work piece. Climbing, turning, propping time is *waste* time.



But this With a Worthington-Ransome Welding Positioner continually bringing work into position for convenient down-hand welding, your welders spend less time handling, more time welding.



Not this... Why do it the hard way when you can get it done the easy way?



But this Manual or automatic welding really pays off when you use Worthington-Ransome Turning Rolls to rotate the work. This way, output goes up as much as 50% on either repetitive or job work.

Welding Positioner capacities from 100 lb to 20 tons. Turning Rolls from 3 to 150 tons, stationary and self-propelled.

Write for Positioner or Turning Roll Bulletin, Worthington Pump and Machinery Corporation, Welding and Assembly Positioning Equipment Division, Dunellen, N. J.

WORTHINGTON

An Unbeatable Combination!
SILVALOY
SILVER
BRAZING ALLOYS
The Silvaloy group consists of 7 popular silver brazing alloys high in tensile strength and producing strong, ductile joints on ferrous and non-ferrous metals.
SILVER CONTENT MELTING POINT FLOW POINT
SILVALOY 50 50% 1160 F 1175 F
SILVALOY 45 45% 1125 F 1145 F
SILVALOY 40 40% 1135 F 1205 F
SILVALOY 35 35% 1125 F 1295 F
SILVALOY 20 20% 1430 F 1500 F
SILVALOY 15 15% 1185 F 1280 F
SILVALOY 503 50% 1195 F 1270 F
1200 All-Purpose Flux—for use on all metals. No. 1200 Flux readily dissolves oxides during brazing operations and aids in the flowing of the alloy. Meets all government specifications.
1100 Low Temperature Flux—superior where exceptionally clean surfaces on copper or copper alloys are required at lower temperatures.
1200 FLUX
COMPLETE STOCKS
Oxy-acetelyne welding rods and flux for cast iron, steel, aluminum, brass, copper, bronze, nickel, monel and inconel.
STEEL SALES
CORPORATION
3348 SOUTH PULASKI ROAD • CHICAGO, ILLINOIS
BRANCH PLANTS: Detroit, St. Louis • BRANCH OFFICES: Milwaukee, Minneapolis, Grand Rapids, Indianapolis, Kansas City, Mo.

Died . . .

OTTMAR M. KREMBS, 73, president of Krembs & Company, welding flux manufacturers, died in Evanston, Ill., on Nov. 17.

* * *

CHARLES HENRY WOOLLEY, 44, assistant manager of the proposition department of The Babcock & Wilcox Co., New York City, died Nov. 11 in Cranford, N. J. He was a noted boiler design engineer.

* * *

30 YEARS AGO

(From THE WELDING ENGINEER of Jan., 1921)

FIVE full years of service to the welding industry are marked with this issue of THE WELDING ENGINEER.

—30 YEARS AGO—

THE Canadian Welding Society was formed this month in Toronto. The first organizational meeting was in the Prest-O-Lite Company offices in Toronto on Dec. 16. Joseph N. Robinson, managing editor of *The Canadian Welding Journal* was appointed chairman and A. A. Stewart, secretary. With F. Borys, commercial manager of L'Air Liquide Society, they formed an executive committee that carried on before formal organization of the society.

—30 YEARS AGO—

FAVORABLE comment in the *Engineer*, conservative British engineering journal, is as follows: "It's (welding) advantages are so obvious and appear to be so great. Welding can be carried out not only with much less labor, but with much greater speed and convenience than by the old method of making joints. By comparison, riveting, involving as it does, the drilling or punching of holes in accurately determined positions, followed by the insertion of the rivets themselves, is a clumsy and costly operation."

—30 YEARS AGO—

UNIQUE advertising slogans get business for a Hickory, N. C., welding job shop. A phrase in big type, "If You Are Broke, See Us" tops off a list of broken metal parts and fixtures the Hickory Brazing & Welding Company can salvage and repair.

—30 YEARS AGO—

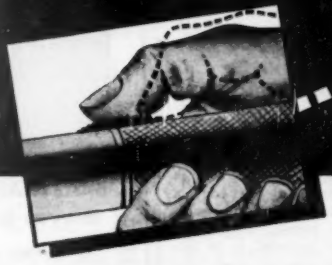
ONE of the largest welded tanks ever fabricated was recently delivered to The Liquid Carbonic Company by Welded Products Company, Birmingham, Ala. The tank is 22 ft in diameter and 30 ft high. Made of ¼ in. plates, it was acetylene welded.

—30 YEARS AGO—

FROZEN fire hydrants in New York City were recently thawed quickly and safely by a new acetylene torch device having ten tips. The burner heats a steam coil that in turn provides high pressure, high temperature steam to melt the frozen ice inside the hydrant.

Every Time you use the button...

1. You save money by preventing the waste of Oxygen and Acetylene that occurs every second a torch flame burns yet is not actually applied to work.
2. You save time by eliminating constant lighting, flame adjusting and Torch shut off. This adds materially to output of work.
3. You make life easier for the torch operator. A single quarter-inch movement of the thumb accomplishes the same result as a dozen or more motions, involving both hands.
4. You bring your operations up-to-date by as big an improvement as that made when self starters were added to automobiles — more so, in fact, since the Harris Automatic Torch repays its entire cost many times over in cash savings.
5. When you next see a torch burning, without being applied to work, decide to DO something about it! Cantact the nearest Harris Exclusive Distributor, located in principal Cities. Better yet, do it now.



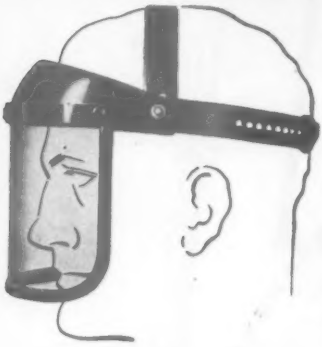
THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

STOP FLYING PARTICLES
MOLTEN METAL LIGHT GLARE
DUST WOOD CHIPS SAWDUST
METAL FRAGMENTS **with**



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TYPE J-1
EYESHIELD

PROTECTS EYES AND FACE

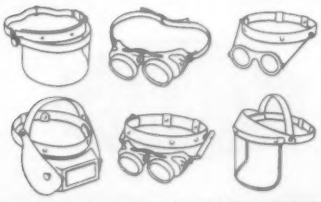
IN METAL FINISHING METAL POURING
SPOT AND FLASH WELDING WOODWORKING
AND MANY OTHER OPERATIONS

Few ounces of weight give pounds of protection against many industrial hazards.

Jackson J-1 Eyeshields weigh only 5½ ounces, have saved thousands from serious injuries and countless expense. They help to keep production flowing in many industries.

Available in Clear and in Three Shades of Green, Visors are 4, 6, and 8 inches deep

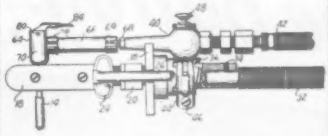
JACKSON
PRODUCTS
WARREN • MICHIGAN



SOLD EVERYWHERE BY SAFETY SUPPLY DEALERS AND WELDING SUPPLY HOUSES

Arc Oxygen Cutting

2,524,223. Fred J. Giroux, Hartford, Conn. Filed Jan. 21, 1947. Granted Oct. 3, 1950.

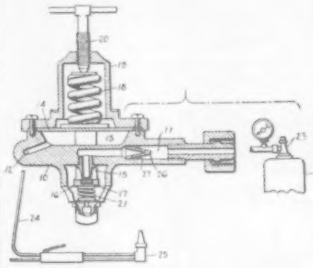


Newly patented accessory for use with electrode holders is designed to provide oxygen for cutting fuel at the arc. The accessory includes a normally closed, hand-operated valve connected to an oxygen supply, a clamp with the valve, and an adapter head connected with the valve to receive oxygen. An apertured resilient body is adapted to surround and fit the end portion of the hollow electrode so as to supply oxygen to it.

* * *

Oxygen Regulator

2,524,231. Chester Mott. Evanston, Ill. Assigned to National Cylinder Gas Co., Chicago. Filed Feb. 9, 1946. Granted Oct. 3, 1950.



Patent covers a gas pressure regulator for high-pressure oxygen. It has a casing enclosing a diaphragm, a high pressure inlet passage, a valve and a valve seat. The latter is movable with the diaphragm. A porous diaphragm of non-combustible material is in the inlet passage and spaced from the valve seat. The porosity of the diaphragm is sufficient to permit normal flow of oxygen without substantial pressure drop during normal operation but insufficient to permit such rapid flow upon sudden opening of a high pressure oxygen supply valve as will produce recompression and high heat production at the valve seat.

REED ENGINEERING COMPANY
1007 W. Fairview Carthage, Mo.

REED OFFSET FORMING MACHINE
★ IMPROVES AUTOMATIC WELDING PRODUCTION BY ELIMINATING CHILL-RINGS & BACKING BARS. ★ FORMS OFFSET, WELD-BACKING JOGGLE FROM TANK SHELL ★ LOOSENS MILL-SCALE & RUST ★ IMPROVES SHELL ROUNDNESS, SPEEDS FIT-UP.

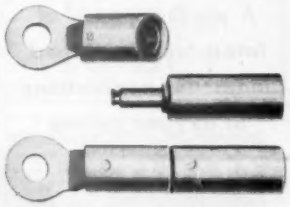
IN TWO MODELS
M-2—1/16 TO 3/16 IN. PLATE
M-4—3/16 TO 7/16 IN. PLATE

WRITE FOR BULLETIN 73A

★ MODERN METALWORKING MACHINES
★ BENDING ROLLS ★ WELDING FIXTURES
★ FORMING MACHINES ★ TURNING ROLLS
★ SPECIAL MACHINES & FIXTURES

TILLMAN
GLOVES • GARMENTS

BRAZILIAN DEERSKIN
Gloves and Mittens
The stay soft leather
ask your
DEALER
for
TILLMAN PRODUCTS
JOHN TILLMAN & CO.
LONG BEACH, CALIF.



TWECO TERMINAL CONNECTORS

for Welding Machines

Bolt directly to positive and negative welder studs. Provide easy cable switch to reverse polarity. Simple cable disconnect for quick "Jump-In" of additional cable.

3 Sizes for cables #6 through 4/0

The male plug of TWECO "Sol-Con" and "Mec-Con" Cable Connectors fit the female part of TWECO Terminal Connectors. Sol-Con and Mec-Con Cable Connectors are COMPANION ITEMS.

See Your Welding Supply Distributor

Tweco PRODUCTS COMPANY

TWECO PRODUCTS

WICHITA, KANSAS

METAL BOND

METAL BOND MFG. CO.

Offers Some Aids to Profitable Welding...

★ ALUMINUM SOLDER

Special solder for aluminum—drawn or cast—lynite castings, and die-cast metals. Can be used with soldering iron or under direct flame—self fluxing.

★ HARD SOLDER

Withstands high temperatures, heavy wear, expansion, and contraction—can be flowed in at 620° F. Use with any kind of heat.

★ NO. 10 BRAZING FLUX

Contains Bronze Spelter—specially prepared for brazing Malleable and Cast Iron, Steel, Brass, Bronze, and Copper. Uses lower heat—less expansion and preheating—removes oxides—flows freely. Leaves no glazed surface—easily machined and finished.

Every METAL BOND Product mentioned here as well as those described in our catalog will help you make more money on every welding job. Used by successful welders for a great many years . . . permanent good results.

Send for our pocket-size catalog for information on welding, brazing, and soldering and descriptions of money-saving METAL BOND Products.

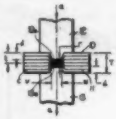
METAL BOND MFG. CO.

3201 KOSSUTH AVE.

ST. LOUIS 7, MISSOURI

Cold Pressure Welding

2,522,408. ANTHONY BAGNOLD SOWTER, Wembley, England. Assigned to The General Electric Co., Ltd., London. Filed Oct. 25, 1949. Granted Sept. 12, 1950.

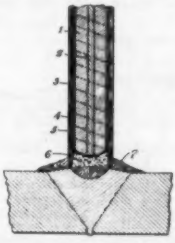


Patent covers the method of cold welding two nonferrous metal pieces at room temperature. First, both surfaces are scratch-brushed of all foreign matter. The cleaned surfaces are placed face to face. A strip-like area about equal to the thickness of the members is then subjected to pressure by special shapes. These apply force at right angles to the metal and in a controlled amount so as to cause 70% reduction in thickness over the strip area. The adjoining metal along the strip cold flows sufficiently to weld the workpieces together.

* * *

Composite Electrode

2,525,852. LUDOVICO MORLON BARBE-BOUJOURS, Vigo-Espineiro, Spain. Filed April 15, 1948. Granted Oct. 17, 1950.



Newly patented electrode has two heat and electrical insulating sleeves and a metallic helix extending down its length. One sleeve melts at a slightly higher temperature than the other sleeve and the helix, so it provides a temporary protective enclosure.

* * *

Nickel Electrode

2,520,806. THEODORE E. KIHLGREN, New Providence Township, Union County, and GEORGE R. PEASE and PIERRE E. LE GRAND, Plainfield, N. J. Assigned to The International Nickel Co., Inc., New York City. Filed Nov. 22, 1949. Granted Aug. 29, 1950.

Newly patented electrode has a core wire of nickel-copper alloy. Its flux has a weight ratio as follows: 26 parts of calcium carbonate, 16 parts calcium fluoride, 25 parts cryolite, 25 parts titania, 5 parts of ferro-85 manganese, 3 parts bentonite, 16 parts of ferro-50 columbium and a binder having 15 parts of sodium silicate, 2.5 parts of invert sugar and water. The electrode is claimed to form weld deposits of high ductility when used on d-c current.

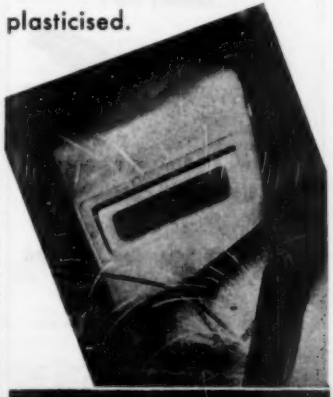
Better than Ever!

THERMO

TRIPLE DUTY SPATTER-PROOF PLASTIC COATED COVER LENSES

NEWLY IMPROVED for TRIPLE DUTY

Positively guaranteed to COST LESS PER WELDING FOOT than any type Cover Lens, whether plain glass, solid plastic, sprayed or plasticised.



THERMACOTE CO.

NEWARK CHICAGO LOS ANGELES PORTLAND

Non-Inflammable and Easily Removed Coatings Prevent Bonding of Welding Spatter & Flash to Metal Parts or Holder Jaws.

SPATTER-EX
FLASH-EX

The original compounds for this purpose

Write for Samples or Send Trial Order

WAYNE CHEMICAL PRODUCTS CO.
Metalworking Oils & Compounds
9500 Copeland St., Detroit 19, Mich.

W-AL-CO RODS

for Welding of ALUMINUM

ELECTRIC AND GAS WELDING

Drawn Wire
TYPES 2S, 43 and 52
Brazing 716

FOR CAST ALUMINUM

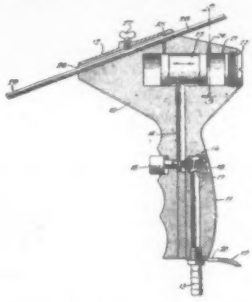
Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

Aluminum Solder
White Metal

Welding Alloys Manufacturing Co.
744 Broad St. Newark 2, N. J.

Arc Welding Tool

2,526,035. KENNETH H. MILLER, Chicago. Assigned to Mid-States Equipment Co., Chicago. Filed Aug. 22, 1945. Granted Oct. 17, 1950.

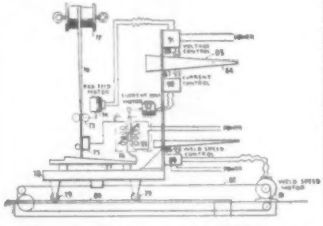


A recently patented welding gun both deposits and peens weld metal on metal workpieces. It includes a body, a metallic electrode and means for vibrating the electrode into and out of engagement with the workpiece to intermittently make and break an arc. At each break, small deposits of metal are deposited and simultaneously peened.

* * *

Arc Welding Method

2,525,657. ISAAC M. DILLER, Glen Ridge, N. J. Filed Aug. 19, 1948. Granted Oct. 10, 1950.



Patent pertains to a method for welding workpieces of varying thickness in a continuous operation. It consists of feeding an electrode of varying mass per unit length toward the weld path at a definite feed rate as the members are moved along the weld path at a definite travel speed. The feed rate and speed are related so that the mass variation of the electrode is greater or less in consonance with the greater or lesser thickness of the moving members.

* * *

Silver Brazing Flux

2,520,206. WALTER GOERG, North Bergen, N. J. Assigned to Air Reduction Co., New York City. Filed Dec. 17, 1948. Granted Aug. 29, 1950.

Patent covers a silver brazing flux having 23 to 28.5% boric acid, from 31 to 35.5% potassium bifluoride, from 23 to 28.5% potassium tetraborate, from 0.105 to 0.125% sodium alginate, 0.015 to 0.025% sodium hexametaphosphate and from 13.88 to 15.88% water.

A practical manual of *latest techniques and industrial applications of oxygen cutting*

HERE is a detailed picture of the current state of the oxygen cutting art . . . of the equipment and techniques used in this process . . . and the many varied applications of the process, both new and old. From this book the reader can get the necessary background of theory and practice that will enable him to increase his skill and to find new and valuable uses for the process. Covers everything from the basic fundamentals to the economics and future of oxygen cutting.

Just Published

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By *George V. Slottman*, Director of Research and Engineering, Air Reduction Co.

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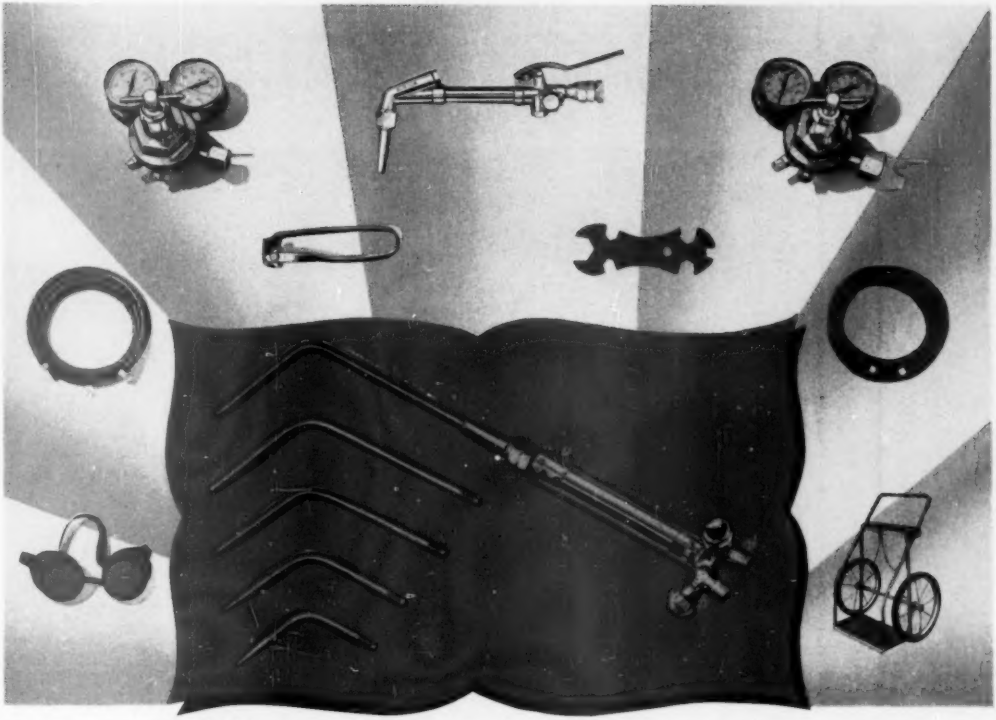

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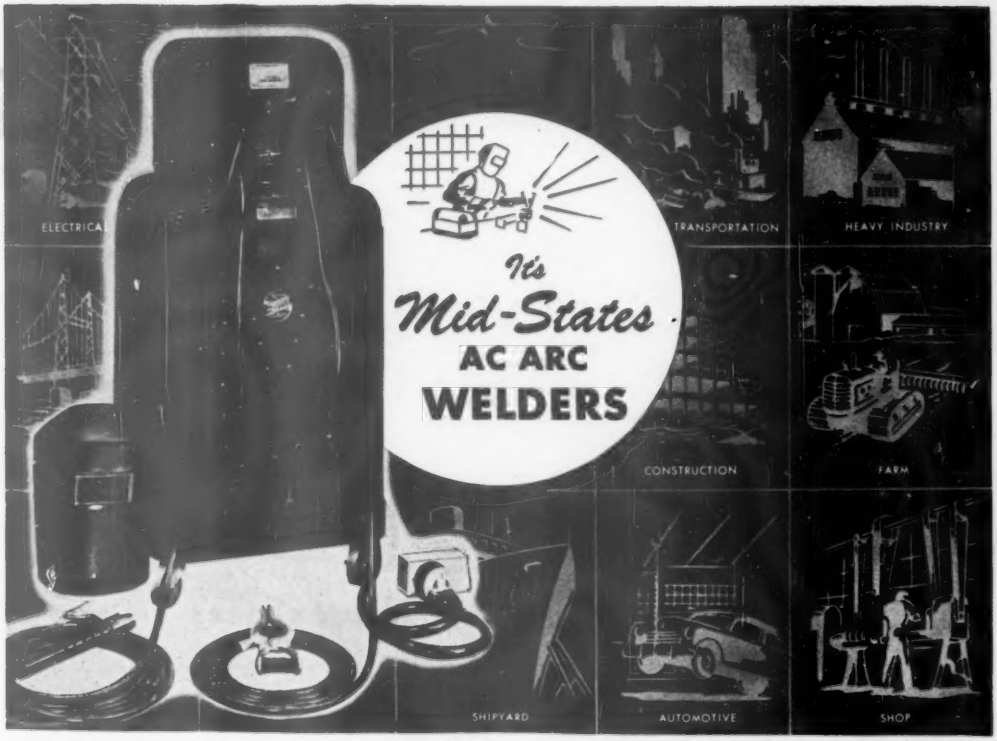

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